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The Optimum Portfolio Based on Konno Linear Programming Model (A Case Study on the Iran Insurance Company)

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Abstract

Iran Insurance Company intends to raise its financial credit and render enhanced services to the insured and the public. The need to meet financial obligations arising from the claims requires determination of the optimum deposited claims reserve with banks. Therefore, the present research study aimed at finding the loss ratio (incurred losses to premium), and determining the optimum portfolio of risky and risk-free assets of insurance companies during 1996-2017 by conducting a case study on Iran Insurance Company. Based on the relevant data, the highest loss ratio with 81 percent belonged to 1998-99 and the lowest ratio with 62 percent belonged to 2003-2004. To determine the optimum portfolio of Iran Insurance Company, Konno Mean-Absolute Deviation Portfolio Optimization Model was utilized. According to the Konno Model, the optimum portfolios of risk-free and risky assets are as follows: Short-term banking deposits with 9 percent, long-term banking deposits with 46 percent, bank certificates of deposits (CDs) and participation papers with 9 percent, stocks of companies listed on Tehran Stock Exchange (TSE) with 17 percent, stocks of companies not listed on the TSE with 11 percent, and other assets, i.e. risky assets, including housing loan for employees of insurance companies, offering facilities to the agencies of insurance companies, purchasing immovable assets, and other financial instruments and constructions with 8 percent.

Keywords: Portfolio Optimization, Konno Linear Programming Model.

JEL Classification: G11, G13, G22.

1. Introduction

Iran Insurance Company, to provide better services for Iranians as

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well as policyholders, is involved in making investment deposits every year. Compensatory payments call for constant attention of the company managers regarding the determination and identification of optimum levels of depositing to make the due payments. Compensation becomes more critical in situations where, due to new obligatory conditions towards policyholders, higher financial loads are imposed on the Insurance Company. For example, in the third party insurance and yearly increases of atonement rate, it is possible to assume that the obligations of the insurance company are different from those set at the concluding section of the contract with the insured party. Consequently, these obligations must undergo changes in accordance with the new conditions. Thus, if Iran Insurance Company fails to determine and implement a proper and optimum level of investment, it will face multilateral problems including the following: customers' dissatisfaction; deterioration of offered services; inability to respond to customers' changing needs; and ultimately, customers' turning away from Iran Insurance Company in the competition. For this reason, under competitive conditions of attracting policy holders, exact appropriate analyses and views with regard to the optimum level of investment can act as competitive advantages for Iran Insurance Company.

2. Theoretical Literature

2.1 Portfolio Risk of Securities

The risk associated with a portfolio is calculated as the standard deviation of that security portfolio. For calculating this risk, we need the following information:

a) Percentage of investment in each portfolio item
b) The variance of Annual return rates for each portfolio item
c) Annual return covariance between two portfolio assets

$$\delta_{i,j} = \frac{1}{N}\sum(R_i - \overline{R}_i)(R_j - \overline{R}_j)$$

If the covariance between two variables is positive, the variables' increase and decrease are coordinated, i.e., an increase in one leads to a corresponding increase in another. However, if the covariance is negative, the two variables change in opposite directions. Therefore, the important factor in portfolio risk is the correlation among investments as well as the standard deviation of the initial investment. For simplicity's sake, we assume that there are only two shares, namely, i and j (Ross, 2007) in the current paper.

Xi : investment percentage in share i & Xj: investment percentage in share j

δ_i^2 : variance of share i δ_j^2 : variance of share j

δ_{ij} : covariance of shares i and j

The Konno Linear Programming Model was used to select the optimum portfolio.

Konno Mean - Absolute Deviation Linear Programming Model

The Konno Model or the Mean-Absolute Deviation Model was proposed in 1991 by Konno and Yamazaki. The prominent characteristic of this model is that, unlike other models in which standard deviation indicates a risk, in Konno Model, the absolute deviation is indicative of risks. Therefore, there is no need to form variance/covariance matrices in the Konno model. In this model, the optimum limit for investment basket can be calculated easily. Moreover, a prominent feature of this model is its high calculating power as well as its simple application (Fannie Mae, 2007).

The target function of the Konno model is given below for determination of the efficient frontier:

$$\textbf{\textit{Min:}}\ w(x) = E \mid \sum R_j X_j - E(\sum R_j X_j) \mid$$
$$\textbf{\textit{s.t:}} \qquad x \epsilon s$$

If we take the expected return for each share in period t as rjt, then the above formula can be written as:

$$E[|\sum R_j X_j - E(\sum R_j X_j)|] = \frac{1}{T}\sum_{t=1}^{T} \mid \sum_{j=1}^{n} (r\,jt - rj)xj \mid$$

First, as the target function is non-linear, we convert it into a linear function. In this model, the constraint size is controlled based on the number of research periods.

$$\textbf{\textit{Min:}}\ w(x) = \frac{1}{T}\sum_{k=0}^{n} y_t$$

$$s.t.:\ y_t \geq \sum_{j=1}^{n}(r_{jt}-r_j)x_j\ ,\ y_t \geq -\sum_{j=1}^{n}(r_{jt}-r_j)\,x_j\ ,\ t=1,\ldots n\ ,\ x\epsilon s$$
$$\&\ s=\{x=(x_1,\ldots,x_n)\}$$

where:

rj: expected return rate for j-th asset ,

rjt: return rate for j-th asset in period t

Restrictions of Konno Model

$$s.t.:\ \sum_{j=1}^{n} r_j x_j \geq \rho M_0\ ,\ \sum x_j = M_0\ ,\ 0 \leq x_j \leq \mu_j \qquad (j=1,\ldots,n)$$

where:

ρ: The return rate requested by the investor

M0: The initial wealth that the investor can provide for entering the investment market (in this study, this is taken equal to 1,000,000 Rials).

μ_j: The maximum investment that the investor is willing to allocate to each share

xj: The investment percentage allocated to each share

Investment Ration in Konno Model

Once the investment types to be considered in the optimum portfolio have been specified, the only thing that remains is the determination of investment ratio in each investment. The investment ratio for each investment type is obtained from the following relations:

$$X_i = \frac{Z_i}{\sum_{i=1}^{n} Z_i}$$

$$Z_i = \frac{\beta i}{\sigma_{ei}^2}\left(\frac{(\bar{R}_j - R_f)}{\beta_i} - C^*\right)$$

The Expected Return

In this model, the portfolio expected return is determined by the share investment return and share investment percentage. In other words, this quantity is calculated from the following formula (Fannie Mae, 2007):

$$r(x_1,\ldots,x_n) = E[\sum_{j=1}^{n} R_j X_j] = \sum_{j=1}^{n} E[\,R_j]X_j$$

For calculating the portfolio risk in this model, the mean absolute deviation formula is used (Fannie Mae, 2007):

$$|\sigma|=\frac{1}{T}\sum_{i=1}^{T}|\sum_{j=1}^{n}(R_{it}-\bar{r}_j)X_i|$$

Utility Function

The utility or indifference function can be expressed in terms of two variables, i.e., the expected return rate and the return variance:

$$U=E(r)-\frac{1}{2}A\sigma^2$$

where:

$$E(r_p)=\sum_{i=1}^{n}x_i r_i \quad , \quad \sigma_p^2=\sum_{i=1}^{n}\sum_{j=1}^{n}x_i x_j \sigma_{ij}$$

U: utility value , A: The investor's coefficient of risk aversion

½: a constant in Sharp's Equation

In this function, depending on whether A is replaced with a number greater than 3, number 3, and a number less than 3, we shall have high, medium, and low-risk aversions respectively (Gökgöz and Atmaca, 2013).

Constraints of the Utility Function

The constraints of the utility function include the following:

$$\sum_{i=0}^{n}Xi=1$$

$$Xi \geq 0 \ \forall \ xi \in \{1,2,\dots,n\}$$

Investors Risk Aversion Level Questionnaire

The standard questionnaire was used to obtain the investors' level of risk aversion. The questionnaire consists of 19 questions that analyze each investor's level of risk aversion (risk-taking) (Moghaddasi and Yazdani, 1997) and consists of two sections. The first section includes 7 open-ended questions about personal and familial particulars as well as investment experiences. The second section consists of 19 questions dealing with the person's readiness to take risks.

2.2 Empirical Studies

Daniel and Thomas (2007) believe that identifying financial strategies of insurance companies can increase their competitive power and consequently improve the qualitative level of services provided for customers. They also propose that insurance companies, through adopting the right strategies, should be able to assess certain damages that might be incurred in the future, so that they can continue improving their services by creating the required flexibility whenever it might be needed. Schwepker and Good (2010) argue that insurance companies should adopt an exact targeted financial system in offering services and undergoing obligations. Thus, they will provide sustainable services in the coming years. Through conducting field studies on financial directors of insurance companies in the City of London, Clarke (2011) investigated the challenges that these companies face in compensatory payments to policyholders entitled for the same. The data gathering tools in the present study were interviews with financial managers of insurance companies. Thirty-seven financial directors participated in the interviews. The research findings showed that identification of the company’s financial situation, its obligations to policyholders, and the provision of the required balance between income and expenses can be considered as keys to the success of insurance companies.

Tocarck et al. (2010) argue that in the current critical economic situation when policyholders are reluctant to purchase the ceiling obligations, the insurance companies are confronted with further challenges so that in practice, they tend to give maximum priority to the achievement of optimum deposit levels in their bank accounts. Di Taoo (2002) holds that the identification of efficient methods of generating income for insurance companies can create a balanced financial-organizational atmosphere in these companies and reduce their unnecessary costs. As a result, the employees will achieve a greater level of organizational trust in their management as well as the department they work in. In a study investigating the financial strategies implemented by insurance companies in France, Clemens (2001) concluded that there was a significant relationship between the amount and method of depositing in the production sector or bank by the insurance company and the compensatory payment method and type made to customers. The results of this field study showed that, through adopting efficient and effective financial policies, insurance companies have succeeded in providing more favorable services to their customers even during financially critical times. In a research study aimed at investigating the financial resources of Alborz Insurance Company, Jahankhani (1999) used the Company's financial information recorded at Tehran Securities Exchange. The findings of this research study indicated that a suitable depositing policy of the company, i.e., adjusting deposits according to inflation rates in Iran's banking system between 1991 and 2001, had provided a favorable competitive advantage for the Company, leading to further developments as compared to other competitors. In a field study, Musavi (2009) investigated appropriate strategies for financial investment in Iran's insurance system. Applying the Delphi Interview Technique, the researcher interviewed 18 scholars on the significance and necessity of financial planning and acquiring bank deposits by insurance companies. According to the findings, the interviewed scholars believed that due to the fluctuations in financial resources and variance in insurance companies in different years, it was required that these companies provide an exact estimation of their deposit volumes in banking systems to be able to enhance their compensatory payment performance and meet their future obligations more successfully.

Khodayari (2001) evaluated the financial-economic investments of insurance companies during seven years from 1995 until 2001. In this field study, the author tried to investigate the situation of investments of private insurance companies during the mentioned period. The obtained results demonstrated that the insurance companies must include the rate of inflation in their financial decision making if they were to reasonably respond to their customers' demands regarding compensatory payments. The researcher proposed that to enable insurance companies to meet their compensatory payment obligations efficiently, the optimum limit for these companies' bank deposits should be determined.

3. Research Questions, Methodology, and Data

1- What is the situation of bank deposits of Insurance Company during the period of 1996-2017?

2- What is the amount paid in compensation/damages to policyholders by Iran Insurance Company from 1996 to 2017?
3- With due regard to future obligations of Iran Insurance Company, what would be the optimum limit for the Company's bank deposits?

The statistical population in this research study includes all the documents, financial resources, and financial statements published by Iran Insurance Company, the reports prepared by independent auditors and legal inspectors, and information regarding Iran Stock Exchange Organization.

Since all the information from Iran Insurance Company corresponds to the period of 1996-2017, and the main discussion in the current paper also refers to the same period, the same Sampling Method was implemented.

The necessary information/data required in this study was obtained from the following sources:

- financial statements issued by Iran Insurance Company,
- reports provided by independent auditors and legal inspectors presented by the Auditing Organization,
- information on depositing/stock returns published by Iran Securities and Stock Exchange Organization,
- and the statistics published by Iran Central Bank.

Question 1: What is the Situation of Bank Deposits of Iran Insurance Company during the period of 1996-2017?

To address the first question, the investments by Iran Insurance Company were divided into two categories of risky investments and risk-free investments. Table 1 shows the way these investments were allocated.

Table 1: Investments in the 1996-2017 Period by Iran Insurance Company

	Risk-Free Investments				Risky Investments			
Year	**Short-Term Bank Deposits**	**Long-Term Bank Deposits**	**Securities (Term Deposit Certificates) (in Rial or Foreign Currency) – Participating Bonds**	**Sum**	**Exchange Company Shares**	**Non-Exchange Company Shares**	**Other**	**Sum**
1996	11%	55%	6%	72%	12%	14%	2%	28%
1997	12%	45%	4%	61%	15%	20%	4%	39%
1998	10%	42%	9%	61%	16%	16%	7%	39%
1999	7%	46%	12%	65%	16%	18%	1%	35%
2000	11%	74%	2%	87%	5%	5%	3%	13%
2001	8%	73%	2%	83%	6%	8%	3%	17%
2002	8%	65%	8%	81%	14%	5%	0%	19%
2003	9%	46%	8%	63%	30%	4%	3%	37%
2004	13%	40%	10%	63%	21%	8%	8%	37%
2005	17%	42%	5%	64%	25%	5%	6%	36%
2006	14%	45%	5%	64%	29%	1%	6%	36%
2007	10%	52%	0%	62%	25%	7%	1%	38%
2008	12%	52%	3%	67%	25%	3%	5%	33%
2009	13%	50%	4%	67%	23%	1%	9%	33%
2010	12%	51%	3%	66%	22%	6%	6%	34%
2011	12%	51%	4%	67%	22%	4%	5%	31%
2012	13%	51%	4%	68%	21%	3%	3%	29%
2013	14%	51%	4%	69%	21%	4%	4%	29%
2014	13%	52%	3%	68%	23%	4%	6%	33%
2015	12%	52%	3%	67%	22%	7%	4%	33%
2016	13%	52%	4%	69%	23%	5%	3%	31%
2017	14%	53%	3%	70%	24%	3%	2%	30%
Mean	10%	50%	5%	66%	24%	6%	4%	34%

Source: Iran Insurance Company Balance Sheets (1996-2017).

As can be observed in Table 1, the most investments by Iran Insurance Company were in the form of long-term bank deposits with a mean value of 5%, and the least investments in the form of securities (term deposits in Rial or foreign currency, and participating bonds) with an identical (5%) mean value.

Question 2: What is the Amount Paid in Compensation/Damages to Policy Holders by Iran Insurance Company between 1996 and 2017?

Table 2 shows the amounts paid as compensation by Iran Insurance Company between 1996 and 2017.

Table 2: Compensations Paid from 1996 to 2017 by Iran Insurance Company

Year	Premium Received (Million Rial)	Compensation Payment (Million Rial)	Compensation /Premium Ratio (%)
1375	650,627	461,662	71
1376	824,443	607,125	74
1377	1,007,965	793,354	79
1378	1,493,527	1,046,080	70
1379	2,177,743	1,517,795	70
1380	3,211,672	2,417,610	75
1381	5,228,916	3,312,515	63
1382	6,998,820	4,180,356	60
1383	9,353,668	5,596,549	60
1384	11,682,713	7,724,597	66
1385	13,305,610	9,220,247	69
1386	16,374,630	11,864,532	72
1387	19,063,000	13,510,521	71
1388	21,813,348	16,095,729	74
1389	23,716,298	17,439,321	74
1389	24,785,589	19,452,804	74
1390	26,357,770	21,263,750	74
1391	29,946,311	23,366,099	73
1392	33,457,692	26,356,910	73
1393	36,980,442	29,479,233	75
1394	39,682,509	31,368,298	72
1395	45,257,091	33,269,214	76
1396	49,472,802	36,697,590	73

Source: Iran Insurance Company Balance Sheets (1996-2017).

As can be seen in Table 2, the maximum and minimum compensations to premium ratios occurred in 1998 (79%) and 2003 (60%) respectively.

Question 3: With due regard to the future obligations of Iran Insurance Company, what would be the optimum limit for the Company's bank deposits?

To answer the third question, the following steps were followed by Figure 1.

The target function of the mentioned model is:

$$\textbf{\textit{Min:}}\ w(\mathrm{x}) = \mathrm{E}\ [\sum \mathrm{R_jX_j} - \mathrm{E}\ (\sum \mathrm{R_jX_j})] \qquad (1)$$
$$\textbf{\textit{s.t:}}\ \mathrm{x} \in \mathrm{s}$$

Upon considering *rjt* as the expected return per share, we can rewrite the above formula as:

$$\mathrm{E}\ [\ |\ \sum \mathrm{R_jX_j} - \mathrm{E}\ (\sum \mathrm{R_jX_j})\ |\ ] = \frac{1}{T} \sum_{t=1}^{T} |\ \sum_{j=1}^{n} (\mathrm{r\,jt} - \mathrm{rj})\mathrm{xj}\ | \qquad (2)$$

Since the target function is non-linear, we first convert it into a linear function. In this model, the constraint size is controlled by the number of research periods.

$$\textbf{\textit{Min:}}\ w(\mathrm{x}) = \frac{1}{T} \sum_{k=0}^{n} \mathrm{y_t}$$

$$\textbf{\textit{s.t:}}\ \mathrm{y_t} \geq \sum_{j=1}^{n} (\mathrm{r_{jt}} - \mathrm{r_j})\ \mathrm{x_j} \qquad \mathrm{t} = 1,\ldots,\mathrm{n}$$

$$\mathrm{y_t} \leq -\sum_{j=1}^{n} (\mathrm{r_{jt}} - \mathrm{r_j})\ \mathrm{x} \qquad \mathrm{t} = 1,\ldots,\mathrm{n} \qquad (3)$$

$$\mathrm{x} \in \mathrm{s} \qquad \mathrm{s} = \{\ \mathrm{x} = (\mathrm{x_1},\ldots\ \mathrm{x_n})\ \}$$

where:

rj: expected return rate for j-th asset

rjt: expected return rate for j-th asset during period T

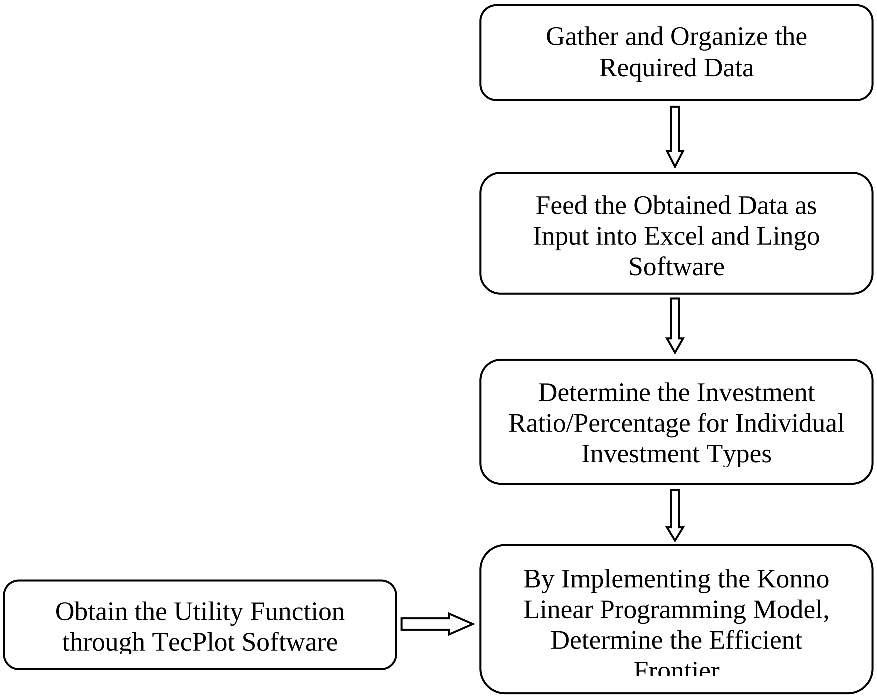

Figure 1: Structure of Konno Linear Programming to Determine Portfolio Efficient Frontier

The Konno Model Restrictions

s.t: $\sum_{j=1}^{n} r_j x_j \geq \rho M_0$

$$\sum x_j = M_0 \qquad (4)$$

$$0 \leq x_j \leq \mu_j \qquad (j = 1, \ldots\ldots\ldots n)$$

where:

ρ: The return rate requested by the investor

M_0: The investor's initial wealth provided for investment (assumed to be equal to 1,000,000 Rials in this study)

jμ: The maximum amount allocated to each share by the investor

xj: The investment percentage allocated to each investment type.

According to the Insurance Institutions Investment Bylaw, dated Feb 2, 2010, and under the regulations on compensatory payment, investment types and the limitations thereof (which are added to the model limitations) are given in Table 3:

Table 3: Model Limitations According to the Investment by Law

Variable	Investment Type	Limitation
X1	Short-Term Bank Deposits	Minimum 5%
X2	Long-Term Bank Deposits	Minimum 25%
X3	Term Deposit Certificates and Participating Bonds	Maximum 10%
X4	Exchange Companies Shares	Maximum 40%
X5	Non-Exchange Companies Shares	Maximum 20%
X6	Construction	Maximum 20%
X7	Other Financial Tools	Maximum 10%
X8	Purchase of Immovable Property	Maximum 10%
X9	Lending Facilities to Representatives	Maximum 5%
X10	Housing Loans/Mortgages to Insurance Companies Employees	Maximum 5%
X11	Percentage of Technical Reserves of Life-Insurance concerning the achieved premiums	Equal to 20%
X12	Percentage of Technical Reserves of other types of insurance (exempt Life-Insurance) for the achieved premiums	Between: Min 3% & Max 10%
X13	Item X13 mustn't exceed than 20% of the average of the last three years	Max 20%

Source: No. 60 set forth by Iran High Council on Insurance.

As the only available data for variables X6 to X10 corresponded to the period between 2006 and 2010, these variables were collectively considered as “other investments” (X14) and given a maximum mean value of 8% (X11<8%). With due attention to the limitations of the Konno Model, we must substitute the requested return rates (12 to 30 percent) in the target function (Equation 3) to determine the efficient frontier. Thus, the rjt-rj variable in the Konno target function is calculated. The calculated results are given in Table 4.

Table 4: Calculated rjt-rj Values for Konno Model

X1	0.55	0.58	3.05	5.78	3.12	3.07	4.57	7.43	3.21	20.63	13.75	6.1	10.29	4.96	3.86
X2	5.32	2.96	1.17	2.65	8.53	7.63	6.03	5.62	0.72	1.35	1.62	1.93	-0.16	5.33	10.74
X3	2.18	-0.83	0.64	10.03	-4.47	-4.56	-5.87	-1.94	10.44	5.72	3.79	5.42	4.86	-0.78	-4.83
X4	2.78	3.67	-1.02	-5.07	8.79	0.84	12.11	3.67	2.32	1.38	18.03	2.48	-1.94	1.58	-4.96
X5	4.86	7.43	10.07	9.51	6.42	2.63	8.96	-4.63	-3.67	8.95	11.86	9.35	-8.97	4.49	-2.73
X14	4.77	8.79	9.91	2.66	3.36	3.08	15.55	1.28	0.83	0.43	5.02	-3.17	9.03	7.73	8.33

Source: Research findings.

Table 5 shows the expected return rates and annual risk values obtained by entering the requested return rates (ρ) as input in the [12%-30%] interval (Fannie Mae, 2007) in Lingo Software. It is assumed that the funds allocated to each investment type are at most 80% of the investible budget. To convert the monthly requested return rate into the annual requested return rate, we use the following relation:

$$A_t = [\frac{i}{x}] \cdot x$$

where I is the monthly requested return rate and x is the number of months in a year (equal to 12). The expected return rate and the risk are obtained from the following relations (Fannie Mae, 2007):

Investment basket return rate: $\sum_{j=1}^{n} R_j x_j$

Expected return rate: $R(x)) = E(R(x)$

$$\text{Risk: } [E(R_x - r_x)^2]^{\frac{1}{2}}$$

Table 5: Risk and Expected Return Rate Values

Requested Return Rate	Expected Return Rate	Risk
12%	0.097	0.31
15%	0.127	0.32
18%	0.167	0.36
21%	0.193	0.40
24%	0.213	0.24
27%	0.221	0.27

Source: Research finding.

The plotted diagram is shown in Figure 2.

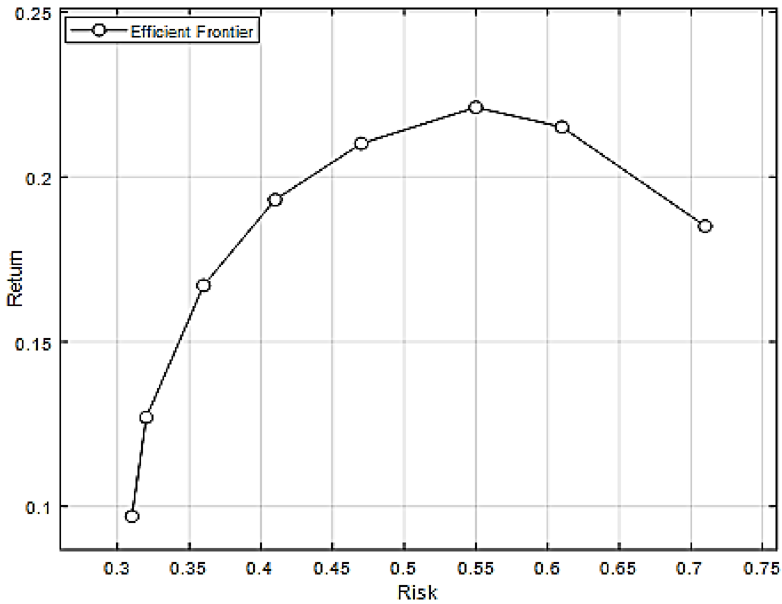

Figure 1: Extracted Market Efficient Frontier
Source: Research calculation.

Utility Function

Utility function or indifferent function can be expressed in terms of two variables, the expected return rate and the return variance (Gökgöz and Atmaca, 2013):

$$E(r_p) = \sum_{i=1}^{n} x_i r_i \quad , \quad \sigma_p^2 = \sum_{i=1}^{n} \sum_{j=1}^{n} x_i x_j \sigma_{ij}$$

where:

U: utility value, A: The investor’s risk aversion, ½: equation constant

To obtain the risk-taking level (A) corresponding to senior managers of Iran Insurance Company from the utility function, a questionnaire was sent to four of them. Upon examining their answers, a value equal to 5 was obtained for A which is indicative of risk aversion among the managers of Iran Insurance Company. To obtain the minimum risk for a higher return rate in the investment basket, the following limit must be calculated with due attention to the investors’ (Iran Insurance Company managers) risk aversion level (Gökgöz and Atmaca, 2013):

$$\lim_{A \to \infty} \{ Max_{x_n} U = E(r) - \frac{1}{2} A\sigma^2 \}$$

Upon calculating the above-mentioned limit and combining the result in the MATLAB Software environment with the efficient frontier, the following diagram was obtained showing the weight of each investment in the investment basket of Iran Insurance Company.

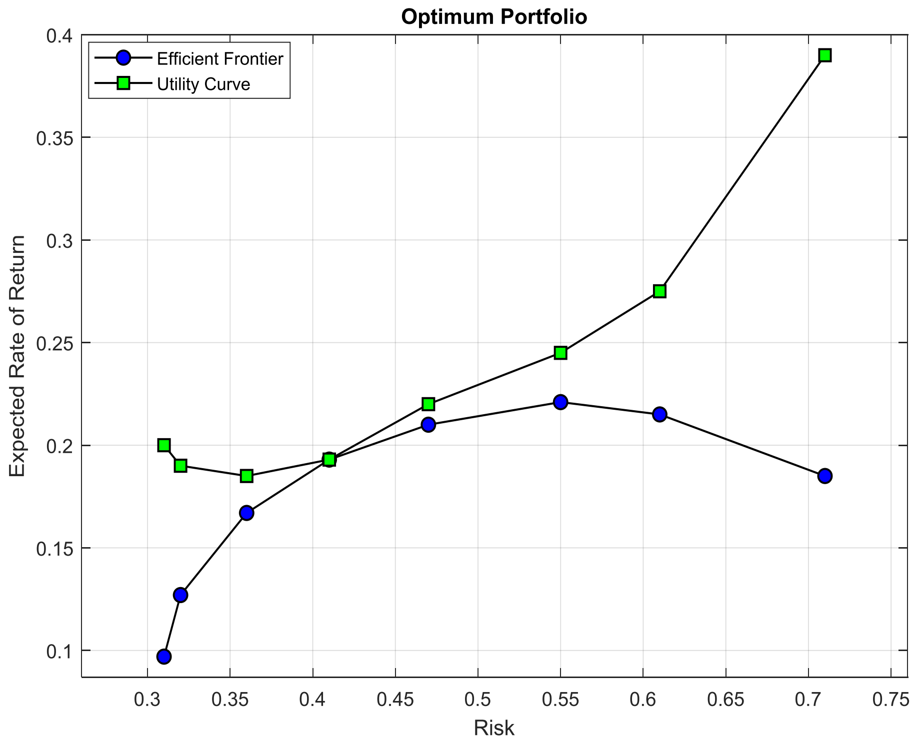

Figure 2: Estimation of Optimum Portfolio

Source: Research computations.

3. The Optimum Point in Iran Insurance Company Portfolio

Upon bringing the utility function into single-point contact with the efficient frontier curve according to Equation (4), the optimum point is located at the following coordinates:

Risk: 0.33; Return: 0.135, by substituting this point in Eq.3 share values for possible investments at the optimum point for Iran Insurance Company can be obtained. These values are given in Table 6.

Table 6: Possible Optimum Investment Points of Iran Insurance Companies

Variable	Investment Type	Share in the Investment Basket
X1	Short-Term Bank Deposits	0.12
X2	Long-Term Bank Deposits	0.43
X3	Term Deposit Certificates and Anticipating Bonds	0.09
X4	Exchange Company Shares	0.19
X5	Non-Exchange Company Shares	0.12
X14	Other	0.05

Source: Research findings.

As can be seen in Table 3-8, the most and the least investment shares in the investment basket of Iran Insurance Company belong to the long-term bank deposits (45%) and other investments (6%) (including housing loans to the employees of an insurance company, offering facilities to representatives, purchasing immovable property, other financial tools, and construction) respectively.

4. Conclusion and Policy Recommendations

Concerning the optimum investment basket limit of Iran Insurance Company, the obtained results specify this point as corresponding to the following coordinates: Risk=0.33 and Return=0.135 where the risky investment and the risk-free investments account for 34% and 66% of the investment basket respectively. So, the results of this study suggest that:

1. According to the questionnaire results and model assumptions, as the senior managers of Iran Insurance Company are inclined towards risk aversion, the optimum point in the investment basket has the coordinates: Risk=0.33 and Return=0.135, and the investment percentages obtained for Iran Insurance Company are as follows:

Short-term bank deposits share: 12%
Long-term bank deposits share: 43%
Term deposits and participating bonds share: 9%
Exchange company investment share: 19%
Non-exchange company investment share: 12%
Other risky assets investment share: 5%

Therefore, it is suggested that a similar research study should be conducted to implement similar methods of the current paper and also historical or predicted information obtainable from insurance companies in the future.

2. Paying attention to the 70% mean value obtained for the compensatory payment to premium ratio and the high-profit margin obtained, the managers of Iran Insurance Company can achieve greater profitability by taking greater risks.

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