

Ranking insurance firms using AHP and Factor Analysis

Mohammad Khodaei Valahzaghari^{a*} and Mahnaz Ferdousnejhad^b

^aAssist. Prof, Department of Financial Management, Science and Research branch, Islamic Azad university (IAU), Tehran, Iran

^bM.Sc. Student, Department of Financial Management, Science and Research branch, Islamic Azad University (IAU), Tehran, Iran

CHRONICLE

Article history:

Received October 1, 2012

Received in revised format

22 January 2013

Accepted 23 January 2013

Available online

January 23 2013

Keywords:

Insurance firms

Factor analysis

Analytical hierarchy process

ABSTRACT

Insurance industry includes a significant part of economy and it is important to learn more about the capabilities of different firms, which are active in this industry. In this paper, we present an empirical study to rank the insurance firms using analytical hierarchy process as well as factor analysis. The study considers four criteria including capital adequacy, quality of earning, quality of cash flow and quality of firms' assets. The results of the implementation of factor analysis (FA) have been verified using Kaiser-Meyer-Olkin (KMO=0.573) and Bartlett's Chi-Square (443.267 P-value=0.000) tests. According to the results FA, the first important factor, capital adequacy, represents 21.557% of total variance, the second factor, quality of income, represents 20.958% of total variance. In addition, the third factor, quality of cash flow, represents 19.417% of total variance and the last factor, quality of assets, represents 18.641% of total variance. The study has also used analytical hierarchy process (AHP) to rank insurance firms. The results of our survey indicate that capital adequacy (0.559) is accounted as the most important factor followed by quality of income (0.235), quality of cash flow (0.144) and quality of assets (0.061). The results of AHP are consistent with the results of FA, which somewhat validates the overall study.

1. Introduction

Performance measurement is one of the most important issues in today's economy and many people prefer to have some idea on ranking different firms, which are active in one industry (Jarraya & Bouri, 2013). Any ranking strategy involves various criteria and, therefore, we need to use multi criteria decision making for ranking different alternatives such as Analytical hierarchy process (AHP) (Saaty, 1992), data envelopment analysis (DEA) (Charnes et al., 1978, 1994; Andersen et al., 1993), Entropy and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) (Chen & Hwang, 1992). Some of the techniques asks decision maker (DM) to express his/her opinions for ranking preference, for instance AHP (Hsu & Pan, 2009), while some others do not, e.g. DEA. When we wish to prevent from direct communication with DM, we may look for other techniques to rank

*Corresponding author. Tel: +98-912-3443139

E-mail addresses: m_khodaei@iau-tnb.ac.ir (M. Khodaei Valahzaghari)

different alternatives. Jalili Sabet and Fadavi (2013) performed DEA technique in two stages where the first stage considers five inputs and three outputs while the second stage considered the outputs of the first stage as the inputs of the second stage and implemented three various outputs for this stage. The study was held among Iranian insurance firms and the results showed that while there were 4 efficient insurance firms most other insurances were noticeably inefficient. This means market was monopolized mostly by a limited number of insurance firms and competition was not fare enough to let other firms participate in economy, more efficiently. Houshmand Neghabi et al. (2012) implemented two well-known methods of CAMELS and RBC to rank 18 active private and governmental insurance firms in Iran over the period of 2009-2011. The results of Spearman test indicated that there was no meaningful difference between these two methods for year 2010 and year 2011 and according to Freedman test, there was not meaningful difference between these two methods in any three years of 2009, 2010 and 2011.

2. The proposed method

The proposed study of this paper uses two methods of factors analysis (FA) analytical hierarchy process (AHP) to rank insurance firms based on four major criteria including capital adequacy, quality of earning, quality of cash flow and quality of firms' assets. The proposed study includes 15 Iranian insurance firms, which were active over the period of 2006-2010. The study uses 32 financial ratios, which are reduced to 10 ratios during the implementation of FA. Table 1 demonstrates some of the basic statistics on the data used for this survey.

Table 1
Some basic information on the input data

Financial ratios	Mean	Std. deviation	Variance	Skewness	Kurtosis	Deviation coefficient	
						Skewness	Kurtosis
Net premiums insurance issued to total equity	24.687	3.305	4.609	21.247	4.587	24.687	45.032
Total reserves to total equities	27.546	1.910	3.533	12.481	4.753	27.546	50.248
Fixed assets to long-term debt	60.536	0.550	1.832	3.356	7.560	60.536	110.425
Current assets to operating income	16.137	1.672	2.176	4.733	3.583	16.137	29.436
Return on equities	20.071	0.232	0.262	0.069	3.672	20.071	36.612
Operating expenses to net premiums issued	0.128	0.563	0.255	0.065	-0.932	0.128	0.234
Reinsurance commissions received for reinsurance costs	8.660	0.190	0.241	0.058	2.659	8.660	15.797
General and administrative expenses to net premiums	13.445	0.442	0.946	0.894	3.397	13.445	24.525
Total cash to Total Assets	45.358	0.855	1.987	3.950	6.136	45.358	82.739
Current assets to current liabilities	54.778	1.604	3.653	13.346	7.049	54.778	99.922

As explained, there are four major criteria associated with the proposed study and the first criterion is capital adequacy, which is calculated based on Net premiums insurance issued to total equity and Total reserves to total equities. Table 2 shows statistical observations associated with capital adequacy.

Table 2
Some basic information for capital adequacy

Financial ratios	Mean	Std. deviation	Variance	Skewness	Kurtosis	Deviation coefficient	
						Skewness	Kurtosis
Capital adequacy	0.000	1.000	0.999	4.765	27.731	17.177	50.585

The next factor, quality of revenue is calculated based on four ratios including Return on equities, Operating expenses to net premiums issued, Reinsurance commissions received for reinsurance costs, General and administrative expenses to net premiums. Table 3 demonstrates some basic statistics on this factor.

Table 3
Some basic information for quality of revenue

Financial ratios	Mean	Std. deviation	Variance	Skewness	Kurtosis	Deviation coefficient	
						Skewness	Kurtosis
Quality of revenue	0.000	0.967	0.935	2.428	9.079	8.754	16.560

Quality of cash flow is the third factor associated with the proposed study of this paper, which is calculated based on two ratios of Fixed assets to long-term debt and Current assets to operating income. Table 4 shows details of basic statistics associated with this factor.

Table 4

Some basic information for quality of cash flow

Financial ratios	Mean	Std. deviation	Variance	Skewness	Kurtosis	Deviation coefficient	
						Skewness	Kurtosis
Quality of revenue	0.000	0.999	0.998	6.325	47.542	22.802	86.722

Finally, quality of assets is the last component of our survey, which is calculated based on Total cash to Total Assets and Current assets to current liabilities. Table 5 shows details of basic statistics associated with this factor.

Table 5

Some basic information for quality of assets

Financial ratios	Mean	Std. deviation	Variance	Skewness	Kurtosis	Deviation coefficient	
						Skewness	Kurtosis
Quality of assets	0.000	0.941	0.885	5.432	38.364	19.581	69.980

The results of Table 2 to Table 5 show that they all maintain means of 0.000 and standard deviations, which are close to one.

3. The results

In this section, we present details of the implementation of factor analysis (FA) for the proposed study of this paper and then the results of using AHP is given.

3.1. Factor analysis

As we have explained, we have chosen ten financial ratios for FA implementation and Table 6 demonstrates the results of FA on these ten factors.

Table 6

The results of FA analysis

Financial ratios	1 st factor	2 nd factor	3 rd factor	4 th factor
1 Net premiums insurance issued to total equity	.972	.033	.030	-.037
2 Total reserves to total equities	.948	-.066	-.071	.041
3 Fixed assets to long-term debt	-.169	.794	-.159	-.017
4 Current assets to operating income	.256	.758	.050	.021
5 Return on equities	-.057	.714	.603	.023
6 Operating expenses to net premiums issued	.452	-.561	-.108	-.056
7 Reinsurance commissions received for reinsurance costs	-.033	.169	.876	.045
8 General and administrative expenses to net premiums	-.019	-.167	.873	-.090
9 Total cash to Total Assets	-.075	.057	-.060	.961
10 Current assets to current liabilities	.064	-.022	.023	.960
Eigenvalue	2.620	1.990	1.893	1.555
% of Variance	21.557	20.958	19.417	18.641
Accumulated	21.557	42.515	61.933	80.574

KMO=0.573, Bartlett's Chi-Square=443.267, P-value=0.000

The results of the implementation of factor analysis (FA) have been verified using Kaiser-Meyer-Olkin (KMO=0.573) and Bartlett's Chi-Square (443.267 P-value=0.000) tests. According to the results FA, the first important factor, capital adequacy, represents 21.557% of total variance, the second factor, quality of income, represents 20.958% of total variance. In addition, the third factor, quality of cash flow, represents 19.417% of total variance and the last factor, quality of assets, represents 18.641% of total variance.

3.2. Analytical hierarchy process

The proposed study of this paper also uses Analytical hierarchy process (AHP) for ranking different insurance firms based on four criteria mentioned earlier in this survey. Fig. 1 shows details of our proposed study.

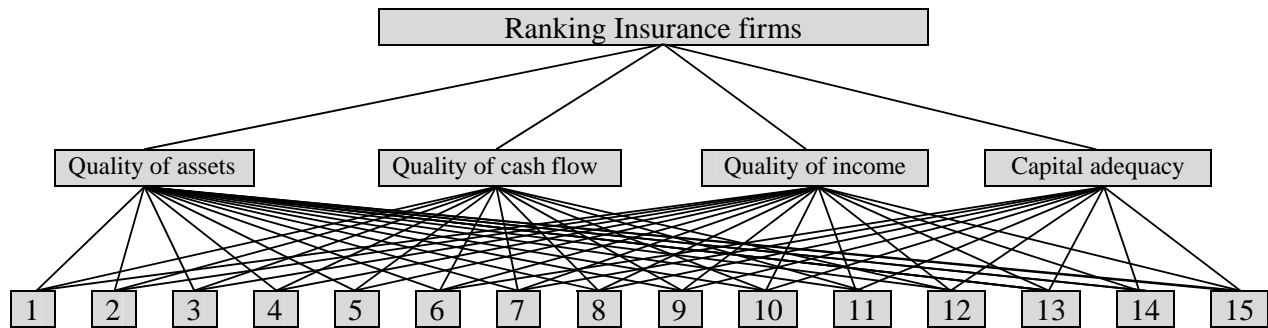
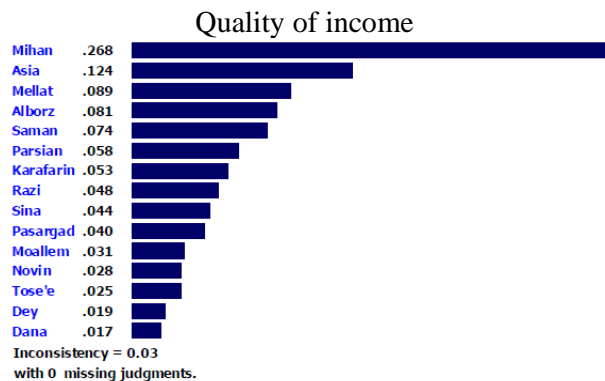
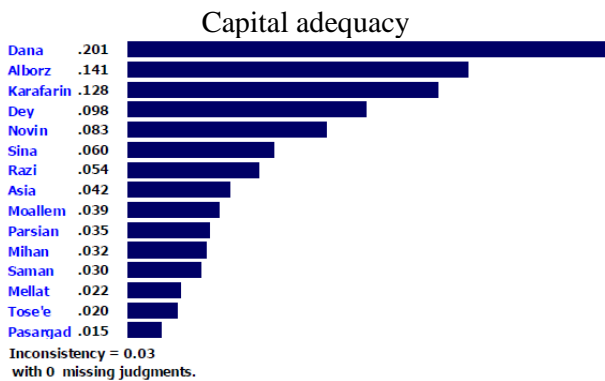
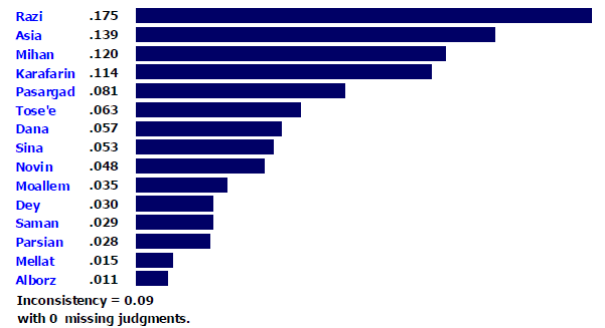
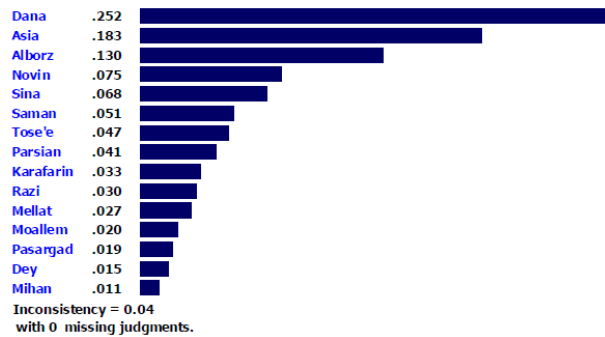


Fig. 1. Analytical hierarchy process (AHP) for ranking 15 insurance firms

According to Fig. 1, there are four criteria, which must be compared in pairs and the results of our survey indicate that capital adequacy (0.559) is accounted as the most important factor followed by quality of income (0.235), quality of cash flow (0.144) and quality of assets (0.061). Inconsistency ratio is equal to 0.02 and no entry has been removed. Fig. 2 demonstrates the results of AHP implementation for each criterion.



Quality of cash flow

Quality of assets

Fig. 2. The results of the implementation of AHP based on four criteria

We have integrated all the information given in Fig. 2 and the results of our survey is summarized in Fig 3.

Overall Inconsistency = .04

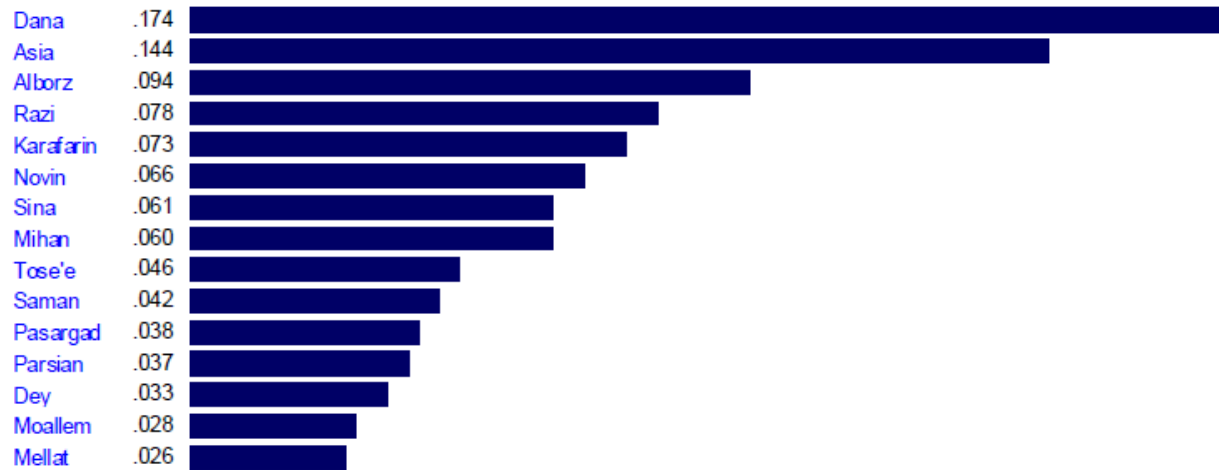


Fig. 3. The summary of ranking 15 insurance firms based on four criteria

According to combined results, Dana insurance company is number one insurance firm followed by Asia and Alborz. In summary, the results of both methods seem to be consistent and we may use this ranking for possible investment opportunity along with other figures.

4. Conclusion

In this paper, we have presented a study to rank the insurance firms using analytical hierarchy process as well as factor analysis. The study implemented four criteria including capital adequacy, quality of earning, quality of cash flow and quality of firms' assets. The results of the implementation of factor analysis (FA) have been verified using Kaiser-Meyer-Olkin ($KMO=0.573$) and Bartlett's Chi-Square (443.267 P -value=0.000) tests. According to the results FA, the first important factor, capital adequacy, represents 21.557% of total variance, the second factor, quality of income, represents 20.958% of total variance. In addition, the third factor, quality of cash flow, represents 19.417% of total variance and the last factor, quality of assets, represents 18.641% of total variance. The study has also used analytical hierarchy process (AHP) to rank insurance firms. The results of our survey indicate that capital adequacy (0.559) is accounted as the most important factor followed by quality of income (0.235), quality of cash flow (0.144) and quality of assets (0.061). The results of AHP are consistent with the results of FA, which somewhat validates the overall study.

Acknowledgment

The authors would like to thank the anonymous referees for constructive comments on earlier version of this work.

References

- Andersen, P., & Petersen, N. C. (1993). A procedure for ranking efficient units in data envelopment analysis, *Management Science*, 39, 1261-1264.
- Charnes A, Cooper, W. W., Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of the Operational Research*, 2, 429-44.

- Charnes A, Cooper W. W., Lewin, A., Seiford, L. M. (1994). *Data envelopment analysis: theory, methodology and applications*. Massachusetts: Kluwer Academic Publishers.
- Chen, S. J., & Hwang, C. L. (1992). *Fuzzy multiple attribute decision making: Methods and applications*. Berlin: Springer-Verlag.
- Houshmand Neghabi, Z., Morshedian Rafiee, S., & Soleymani, Z. (2012). A comparative analysis on ranking insurance firms using RBC and CAMELS. *Management Science Letters*, 2(7), 2545-2550.
- Hsu, T.H., & Pan, F.F.C. (2009). Application of Monte Carlo AHP in ranking dental quality attributes. *Expert Systems with Applications*, 36(2), 2310-2316
- Jalili Sabet, R., & Fadavi, A. (2013). Performance measurement of insurance firms using a two-stage DEA method. *Management Science Letters*, 3(1), 303-308.
- Jarraya, B., & Bouri, A. (2013). Efficiency concept and investigations in insurance industry: A survey. *Management Science Letters*, 3(1), 39-54.
- Saaty, T. L. (1992). How to make a decision: the analytic hierarchy process. *European Journal of Operational Research*, 48, 9-26.