

## Using Analytic Network Process (ANP) in evaluation and prioritization the barriers of credit rating insurance companies in Iran

Kambiz Peykarjou<sup>1</sup>, Nooshin Navab Safavi<sup>2\*</sup>

<sup>1</sup>Management and Economics Department, Science and Research Branch, Islamic Azad University, Tehran, Iran; <sup>2</sup>Business Management (Insurance orientation), Science and Research Branch, Islamic Azad University, Tehran, Iran

\*E-mail: nooshin71078@yahoo.com

### Abstract

Today the credit rating is one of the most important factors in the area of financial services in the field of competition. Unfortunately, the credit rating insurance companies in Iran are faced with barriers that do not allow these ratings to run correctly. This research aimed to identify and prioritize the barriers of credit rating insurance companies in Iran. So, after identifying the factors considered by experts in the field of insurance, to evaluate the importance and priority of these criteria, analytic network process (ANP) methods are used. In the first step, using previous research and literature review, the most important barriers of credit rating insurance companies in Iran were identified and were clustering by three main factors, namely the behavioral barriers, structural barriers and contextual Barriers, and then were confirmed by experts. Then, using a correlation matrix questionnaire based on the opinion of experts, the relationships among these barriers were determined. Then to evaluate the rank and the precedence of these barriers, the pairwise comparisons based on analytic network process method was used. The results show that behavioral barriers among the three categories of barriers with weighing 0.364316 are more important than other factors. Then contextual Barriers with 0.336935 and Structural barriers with 0.298749 are in the next ranks.

**Keywords:** Insurance, Credit rating, Behavioral barriers, Structural barriers, Contextual Barriers, Analytic network process (ANP)

### Introduction

Credit rating is an analysis of the credit risks associated with a financial instrument or a financial entity. It is a rating given to a particular entity based on the credentials and the extent to which the financial statements of the entity are sound, in terms of borrowing and lending that has been done in the past.

A firm's overall credit rating reflects a rating agency's opinion of the firm's overall creditworthiness and its capacity to satisfy its financial obligations. Therefore, it is commonly accepted that high credit ratings indicate a good quality of the firm; the firm can borrow more at lower costs in order to expand investment, hence the firm's fixed investment is positively associated with credit ratings.

Formal ascertainment of the credit ratings matter because it serves as a signal of firm quality for investors and therefore impact the company's cost of capital (Kisgen & Strahan, 2010). A credit rating by providing access to the public debt markets can offer considerable benefits to a firm. Not only does it widen the investor base and improves debt pricing but also provides an opportunity to enter foreign bond markets and gain international visibility, thereby reducing the reliance on local banks. There is also evidence that rated companies suffer less during adverse economic conditions. Faulkender and Petersen (2006), Mitto and Zhang (2008) and Kisgen (2009), find that companies

with a rating have access to broader sources of debt finance, and as a result have higher leverage ratios compared to unrated firms.

Ranking of insurance companies in the insurance industry of Iran, is during the initial stages. Basically, the industry requires to the existence of such process is not well understood. Similarly, there is no a codified system with clear rules for the insurance rating agencies in Iran. Currently, Iran's insurance rating institutions in a primary way , without clear plans and strategies, and sometimes without the appropriate legal environment , without specific codified system, is done directly by the Central Insurance Company. In more general, the ratings of the Iran's insurance industry has not been established. However, it seems that the need to eliminate gaps in the insurance industry in order to create the conditions for service evaluation and ranking of insurance institutions forming. Unfortunately, the credit rating insurance companies in Iran is faced with barriers that do not allow these ratings to run correctly. This research aimed to identify and prioritize the barriers of credit rating insurance companies in Iran using Analytic Network Process method.

### **Literature Review**

*Insurance industry:* Insurance industry extends the productivities and services with providing safety and confidence. Insurance industry also causes stability and reduces the anxiety due to identification. These companies accomplish the governmental social program as well as allocating the sources in a rational manner. Furthermore, these companies have positive effects on economics growth of the country. Therefore, the efficiency of the insurance companies is always under the question mark. Efficiency measurement in the insurance companies increases the quality of their activities and also assists them to identify and solve the problems (Kueng, 2000). The profit is not earned from insurance service alone. An insurance company uses the insurance premium acquired through the systems of agencies, broker, solicitors, etc (Kao, 2008).

*Credit Rating:* Measuring the performance of a production system is an important task for the purpose of control and planning. An assessment of the credit worthiness of a borrower in general terms or with respect to a particular debt or financial obligation. A credit rating is an evaluation of the credit worthiness of a debtor, especially a business (company) or a government, but not individual consumers. The evaluation is made by a credit rating agency of the debtor's ability to pay back the debt and the likelihood of default. A credit rating can be assigned to any entity that seeks to borrow money – an individual, corporation, state or provincial authority, or sovereign government. Credit assessment and evaluation for companies and governments is generally done by a credit rating agency such as Standard & Poor's or Moody's. These rating agencies are paid by the entity that is seeking a credit rating for itself or for one of its debt issues. For individuals, credit ratings are derived from the credit history maintained by credit-reporting agencies such as Equifax, Experian and TransUnion (Kronwald, 2009: 3). Since John Moody pioneered the ratings business of securities in 1909 by publishing publicly available bond ratings focusing solely on railroad companies, credit ratings and rating agencies have evolved over time and come to serve an important role in today's financial markets (Gonis, 2010; White, 2010). The increased role of credit ratings is largely attributable to the expansion and globalization of the financial markets, with a larger number of debt securities issued by corporations and the development of new financial instruments such as asset-backed securities and credit derivatives. It also relates to the increased use of credit ratings in financial regulations and contracting, where credit ratings serve as a credit quality benchmark (Frost, 2007). The three most prominent credit rating agencies (CRAs) in today's financial markets are: 1) Standard & Poor's, 2) Moody's, and 3) Fitch (White, 2010). Commonly, they assign credit ratings for a number of different issuers (e.g. companies, nations and local

governments) of specific debt. These credit ratings are independent assessments designed to measure the fundamental credit strength of issuers of debt, i.e. their ability and willingness to meet ongoing financial obligations as they fall due (Gonzalez et al., 2004; Ogden et al., 2003).

#### ***Credit Rating in the insurance industry***

The role of credit rating agencies in overseeing corporate financial strength and promoting the operation of financial markets has been a topic of intense interest in the finance literature for more than twenty years (Cantor and Packer, 1995 and 1997). Investigation into credit rating practices has recently extended to insurance markets – markets in which the complex technical nature of insurance transactions leads to policyholders, investors and others facing particularly acute information asymmetries at the point-of-sale (Datta and Doherty, 1990). External credit ratings are particularly important in insurance (and other financial service) sectors because of the economic significance of the industry in virtually all developed economies as well as the fact that policyholders place considerable reliance on insurers being sufficiently solvent if and when a claim arises.

Credit ratings have come to serve an important role in today's financial markets, informing market participants about companies' creditworthiness (Gonis, 2010). Gonzalez et al. (2004) point out that achieving a desirable credit rating is frequently incorporated into company goals and represents an integral part of a firm's capital structure policy. Kisgen (2006) found that, due to concerns of discrete costs (benefits), firms near a credit ratings change issued less debt relative to equity than firms not near a credit rating change.

#### **Barriers of credit rating insurance companies in Iran**

Credit rating insurance companies in Iran is faced with barriers. The most important reasons for the existence of these barriers include:

- Get the latest and most accurate data of performance (both financial and operational) for all companies;
- Failure to homogeneity corporate performance under evaluation;
- Mismatch and similar policies and practices of accounting and financial reporting;

The most important barriers to the credit rating insurance companies in Iran can be classified as follows in three categories and sub-criteria:

- a) Behavioral barriers: According to the experts, these barriers include: "Poor understanding of Directors", "Fear of competitors access to information", "Fear of violating the privacy" and "Decreased social communication".
- b) Structural barriers: According to the experts, these barriers include: "Unfavorable structure of the country laws", "Rigid organizational structure" and "Lack of supportive appropriate legislation".
- c) Contextual Barriers: According to the experts, these barriers include: "Lack of organizational infrastructure", "Lack of administrators familiarity with the system", "Little knowledge workers", "High cost of the perform rankings" and "Inadequate staff skills".

In this study, the rating of the barriers by using analytic network process (ANP) is discussed.

#### **Previous studies done in this area**

Shahroudi and et al (2012) in their research, used traditional DEA model and two-stage DEA model to measure the efficiency of Iranian private insurance companies during 2007-2009. The results indicated that the traditional DEA model is not suitable for such kind of network systems. The results indicated that the investment weakness is the main reason of insurance companies' deficiencies during the studied period. In a US survey based on the response of 392 CFOs, Graham

and Harvey (2001) found that maintaining a good credit rating was the second most important factor affecting a firm's financing policy. Kisgen (2006) found that credit ratings directly affected capital structure decisions on the US market in the period 1986 to 2001. In his study, he found that companies near a credit rating upgrade or downgrade issued less debt relative to net equity as a percentage of total assets than firms not near a credit rating change, a finding which is inconsistent with the traditional capital structure theories, as their predictions do not include the impact of credit ratings on capital structure decisions. A similar study performed by Michelsen and Klein (2011) on an international sample in the period of 1990 to 2008 found further evidence of credit ratings' impact on firms' financial gearing decisions. The findings reported in Barron et al. (1997), who employ a sample of 87 firms rated by S&P between 1984 and 1992, suggest that the United Kingdom (UK) market reaction to ratings news is broadly similar to that documented for the US. Pottier (1997 and 1998) points to a recent rise in the attention paid by researchers to the insurance sector as a whole and to credit rating practices in particular; he attributes this to the increased concern exhibited by both regulators and consumers about the financial condition of many major insurers. The current political dimension to the reputation of the insurance industry is demonstrated by the high profile which the recent problems experienced by a number of apparently sound, reputable insurers in the UK such as Equitable Life and Independent Insurance have attracted in the public media. As Bouzouita and Young (1998) note, published credit ratings can perform an important role in this context, and alleviate imperfections in insurance markets by providing interested parties with an opinion on an insurer's financial strength, including its operational performance, and its ability to meet its obligations to policyholders. Raqeeb et al (2012), in their research, found that credit ratings do have an impact on firm's capital structure. It was concluded that firms with higher credit ratings along with other factors (FTOA, ROA and Size) do not tend to have more debt in their capital structure. An and Chan (2008) show that when firms issue IPOs, those with credit ratings are less vulnerable to underpricing than firms without credit ratings. Altamuro (2014) argue that larger companies are more expand than smaller firms to get a credit rating due to their good reputation and diversification. Cantor and Packer (1997), and Pottier (1997) contend that higher the profits, lower the likelihood of financial distress and default and higher motive firms to have a rating. So rating can influence the business of the firm (by supply contract). Ganguin (2005) results that profitability and quality of the assets influence credit rating. Harford and Uysal (2014) show that being rated indeed relaxes financing constraints and has a real effect on investments. Kisgen (2006, 2009), Jung, Soderstrom, and Yang (2013) and Alissa et al. (2013) demonstrate that firms are concerned about their credit rating levels and adjust their corporate policies accordingly in order to attain or maintain specific rating targets.

### **Research methodology**

In this research, model of network analysis process has been used to determine weight of any one of the barriers credit rating insurance companies in Iran. In view of limitation of number of experts, there was no need for sampling and in this research, consensus method was used and 25 existing experts in this industry responded to questionnaires of research. Firstly, to determine type of existing internal and external relations among criteria of model, by using questionnaire of correlation matrix, experts opinions were gotten in this field. Then, to determine intensity of effect of any one of used criteria in research "questionnaire for determination of grade of partial importance of the barriers credit rating insurance companies in Iran by using pairwise comparisons" was designed. This questionnaire was provided for 25 experts of the Insurance industry in Iran. The experts were high-ranking managers of insurance companies who were familiar

to the subject of research. It should be noted that to analyze data and calculate ranks, Super Decisions software has been used.

### Analytic Network Process

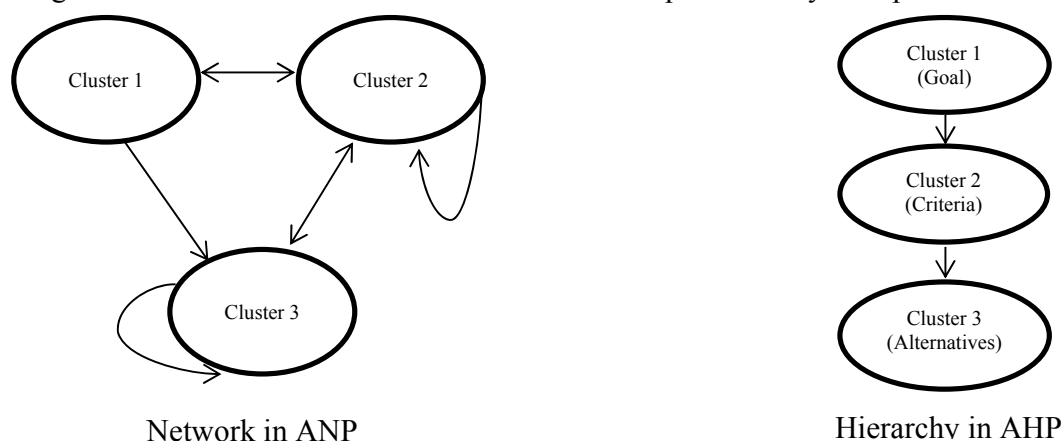
Analytic Network process, is a decision making tool used in complex problems. It involves all kinds of relationship, dependency and feedback in the model and draws a systematical figure of the decision making problem. ANP is the more general form of Analytic Hierarchy process, which generates feasible solutions to hierarchical kind of decision problems.

Using pairwise comparisons, all kinds of subcomponents are being evaluated through ANP. There is a 1-9 scale which is also developed by Thomas Saaty and the pairwise comparisons are measured through this scale (Saaty, 2005). The ANP recently gained a growing popularity because it allows both interactions and feedback between elements (inner dependence) and clusters (outer dependence), in order to capture the complexity of the reality. Operatively, the ANP is structured as a network to represent the problem, as well as a pairwise comparison to establish the relationship within the structure. The applications involve ANP are now quite common in many fields: strategic policy planning (Ulutas, 2005), market and logistics (Agarwal et al., 2006), economics and finance (Niemura and Saaty, 2004) and in civil engineering (Piantanakulchai, 2005; Neaupane and Piantanakulchai, 2006) and territorial and environmental assessment (Promentilla et al., 2006; Lombardi et al., 2007; Bottero and Mondini, 2008; Bottero and Lami, 2010; Abastante et al., 2011). The ANP is a generalization of the AHP (Saaty, 1996). The AHP, also developed by Saaty (1980), is one of the most widely used multiple criteria decision making (MCDM) methods.

The AHP decomposes a problem into several levels that make up a hierarchy in which each decision element is supposed to be independent. The ANP extends the AHP to problems with dependence and feedback. It allows for more complex interrelationships among decision elements by replacing a hierarchy in the AHP with a network (Meade & Sarkis, 1999).

The process of the ANP is comprised of four major steps (Chung et al., 2005; Meade & Sarkis, 1999; Saaty, 1996).

**(1) Network model construction.** The problem is decomposed into a network where nodes correspond to clusters. The elements in a cluster may influence some or all the elements of any other cluster. These relationships are represented by arcs with directions (Figure 1). Also, the relationships among elements in the same cluster can exist and be represented by a looped arc.



**Figure 1. Example of network in ANP and hierarchy in AHP**



through its influence on a third element that has the direct influence on the second element. Such one-step indirect influences are captured by squaring the weighted supermatrix, and two-step indirect influences are obtained from the cubic power of the matrix, and so on. Raising the weighted supermatrix to the power  $2k + 1$ , where  $k$  is an arbitrarily large number, allow convergence of the matrix, which means the row values converge to the same value for each column of the matrix. The resulting matrix is called the limit supermatrix, which yields limit priorities capturing all the indirect influences of each element on every other element. For more details on supermatrix characteristics and theory, see the text by Saaty (1996)

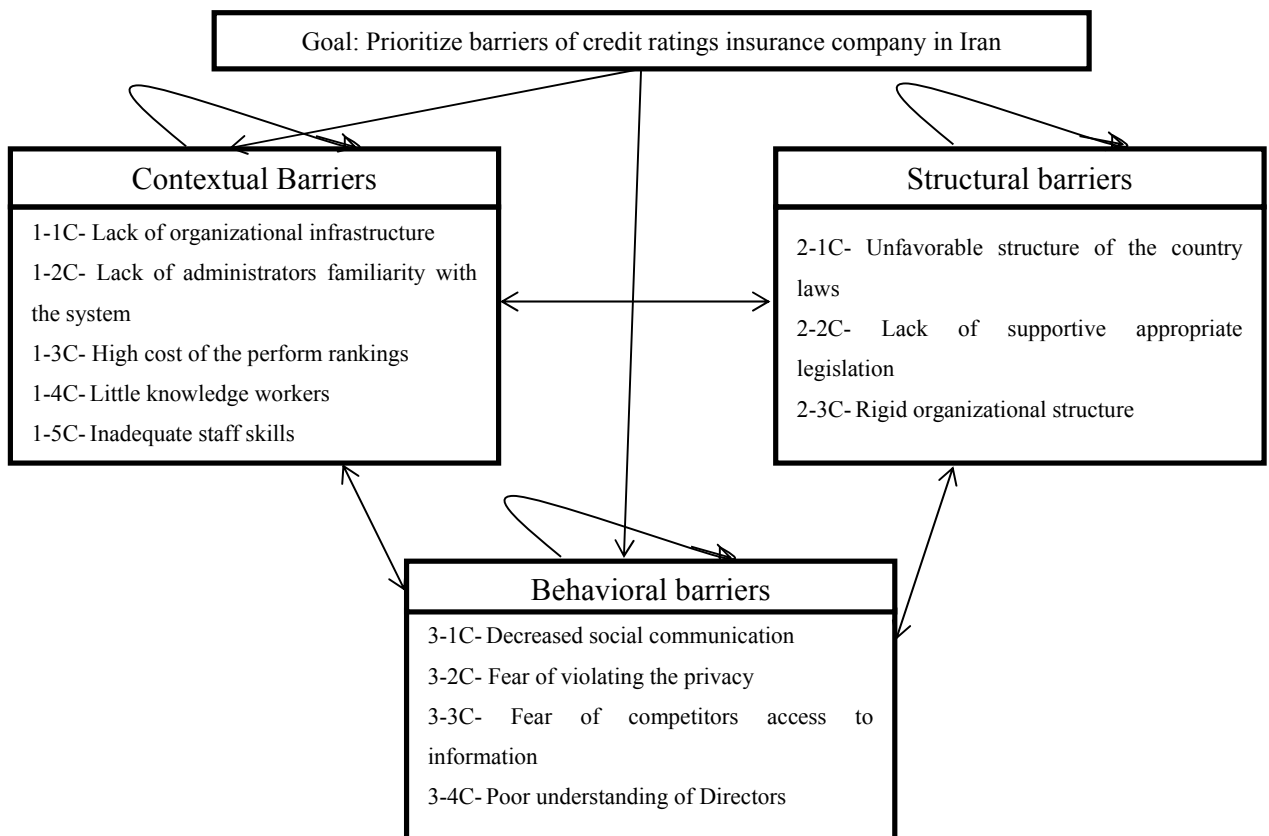
**(4) Final priorities.** When the supermatrix covers the whole network, the final priorities of elements are found in the corresponding columns in the limit supermatrix. If a supermatrix only includes components interrelated, additional calculation should be made.

Analytic Network process is utilized in this paper for understanding the complex relationship between criteria known as the barriers of credit rating insurance companies in Iran. The structure and logic of ANP, which allows utilizing expert judgments in the decision making process, makes it suitable for the problem (Saaty, T., 2005).

### Data analysis

#### Research problem network

ANP network has been drawn in Super Decisions software based on relations recognized between criteria that has been experts opinion.



Point: relations between criteria have been shown in ANP model in figure 1 as internal relations or feedback and also, external relations with other clusters through arrows.

### Obtained priorities for sub-criteria inside clusters

The following table is getting from obtained ranks for sub-criteria inside clusters of problem model of research.

**Table 1. Ranks related to criteria (source: findings of research)**

Cluster Name	Criteria Name	Normalized weights by Cluster	Local Ranks (Rate in Cluster)	Total Weight (Limiting)	Total Ranks	Sum of the weights assigned to each cluster
contextual Barriers	1-1C- Lack of organizational infrastructure	0.26855	1	0.090485	5	0.336935
	1-2C- Lack of administrators familiarity with the system	0.25668	2	0.086484	6	
	1-3C- High cost of the perform rankings	0.16253	4	0.054762	11	
	1-4C- Little knowledge workers	0.13586	5	0.045776	12	
	1-5C- Inadequate staff skills	0.17638	3	0.059428	10	
Structural barriers	2-1C- Unfavorable structure of the country laws	0.33583	2	0.100328	4	0.298749
	2-2C- Lack of supportive appropriate legislation	0.22524	3	0.067289	8	
	2-3C- Rigid organizational structure	0.43894	1	0.131132	1	
Behavioral barriers	3-1C- Decreased social communication	0.17362	4	0.063254	9	0.364316
	3-2C- Fear of violating the privacy	0.31232	1	0.113784	2	
	3-3C- Fear of competitors access to information	0.2823	2	0.102847	3	
	3-4C- Poor understanding of Directors	0.23175	3	0.084431	7	

In view of above table, according to obtained weights in this part the most important criteria can be investigated between all criteria and also, they can be observed among elements inside any cluster and priority of criteria can be also specified based on existing weight in column "Total Weight (Limiting)" and in column of "Normalized weights by cluster", obtained priorities are observable for any criterion in the "Total Rank" column.

### Conclusion

Credit ratings of insurance companies in Iran as one of the critical infrastructure of the insurance industry has a key role in the distribution of benefits among the people. Overall, the main objective of rankings is evaluating the reliability of the insurer. We contend that the results of our research have potentially important implications for firms operating in insurance markets as well as for policy-makers and industry regulators. The study aimed to identify and rank the most important barriers to the credit ratings of insurance companies using the analytic network process was conducted. The study aimed to identify and rank the most important barriers to the credit ratings of



insurance companies using the analytic network process was conducted. The results showed that the following components, respectively have the maximum weight among the barriers to credit ratings of insurance companies from the perspective of experts:

- Rigid organizational structure;
- Fear of violating the privacy;
- Fear of competitors access to information;
- Unfavorable structure of the country laws;
- Lack of organizational infrastructure;

Also, sum of the weights assigned to each cluster show that “behavioral barriers” among the three categories of barriers with weighing 0.364316 is more important than other factors. Then “contextual Barriers” with 0.336935 and “Structural barriers” with 0.298749 are in the next ranks. The study aimed to assess the weight and significance to the barriers of credit ratings of insurance companies in Iran took place. The results of this study indicate that the most important barrier is known to the credit rating insurance companies, non-flexible or rigid organizational structure. Financial strength ratings of insurance companies, tries to provide a general opinion on the financial strength of the insurance business continuity from the policymakers and stakeholders perspective of an insurance company. By identifying and removing barriers in the way of this ranking, a big step towards achieving customer satisfaction would be taken. This study provides several practical and theoretical implications. From a theoretical perspective, by validating the model with ANP, this study offers a foundation for future research in the same industry that need to have credit rating. Its practical application is also made aware of the credit ratings barriers and policymakers pay more attention to it.

#### **Suggestions for Future Research**

To complete the study and better use of the model, the following recommendations can be provide:

1. The use of other decision making techniques such as Dematel, Electre and Topsis and assess their effectiveness in comparison with the method used in this study.
2. Combining fuzzy approach with ANP or any of the methods proposed before that provides better reflect the style of human thinking, it seems to be reliabale results.

#### **References**

- Abastante F, Bottero M & Lami IM (2011). Using the ANP for ranking the critical issues of a transport decision problem: the Italian section of CODE24. In Proceeding of the International symposium on the Analytic Hierarchy Process, 15 – 18 June 2011, Sorrento, Naples, Italy.
- Abdul R., Syed Talal Haider Zaidi & Farooq-E-Azam Cheema (2012). Effect of Credit Rating on Capital Structure: A study on non-financial firms in Pakistan, *Journal of Management and Social Sciences*, 8 (2), 42-49.
- Agarwal A, Shankar R & Tiwari M.K. (2006). Modelling the metrics of lean, agile and leagile supply chain: an ANP-based approach. *European Journal of Operational Research*, 173 (1), 211-225.
- Alissa, W., Samuel, B., Bonsall I., Kevin K., Michael W., Penn J. (2013). Firms' use of accounting discretion to influence their credit ratings, *Journal of Accounting and Economics* 55, 129–147.
- Altamuro, J., R. Johnston, S. Pandit, & H. Zhang . (2014). Operating leases and credit assessments. *Contemporary Accounting Research*, 31 (2), 551–580.

- An, H., & Chan, K.C. (2008). Credit ratings and IPO pricing. *Journal of Corporate Finance*, 14, 584-595.
- Barron, M.J., A.D. Clarke & S.H. Thomas (1997). The Effect of Bond Rating Changes and New Ratings on UK Stock Returns, *Journal of Business Finance & Accounting*, 24, 497–509.
- Bottero M., & Lami, I.M. (2010). Analytic Network Process and sustainable mobility: An application for the assessment of different scenarios. *Journal of Urbanism*, 3, 275-293
- Bottero, M. & Mondini, G. (2008). An appraisal of analytic network process and its role in sustainability assessment in Northern Italy. *International Journal of Management of Environmental Quality*, 19 (6), 642- 660.
- Bouzouita, R. & A.J. Young (1998). A Probit Analysis of Best Ratings, *The Journal of Insurance Issues*, 21, 23–34.
- Cantor, & Packer (1997). Differences of opinion and selection bias in the credit rating industry”. *Journal of Banking and Finance*, 21, 1395-1417.
- Cantor, R. & F. Packer (1995). The Credit Rating Industry, *The Journal of Fixed Income*, 5, 10–34.
- Cantor, R. & F. Packer (1997). Differences of Opinion and Selection Bias in the Credit Rating Industry, *The Journal of Banking and Finance*, 21, 1395–417.
- Datta, P. & N.A. Doherty (1990). The Effects of Organizational Form on Capital Structure: The Case of Stock and Mutual Property-Liability Insurance Firms. In H. Lonberge (ed.), *Risk, Information and Insurance*, Norwell, MA: Kluwer Academic Publishers.
- Dechow, P. (2010). Understanding earnings quality: A review of the proxies, their determinants and their consequences. *Journal of Accounting and Economics*, 50, 344-401.
- Faulkender, M.W., & M. A. Petersen (2006). Does the Source of Capital Affect Capital Structure?, *The Review of Financial Studies*, 19 (1), 45- 79.
- FROST, C. A. (2007). Credit rating agencies in capital markets: A review of research evidence on selected criticism of the agencies. *Journal of Accounting, Auditing & Finance*, 22, 469-492.
- Ganguin, B., & Bilardello, J. (2005). *Fundamentals of corporate credit analysis*, McGraw Hill, New York.
- Gonis, E. (2010). The rating decision and the determinants of credit ratings: An Empirical investigation of UK companies. Doctor of Philosophy, University of the West of England.
- Gonzalez, F., Haas, F., Johannes, R., Persson, M., Toledo, L., Violi, R., Wieland, M. & Zins, C (2004). Market dynamics associated with credit ratings: A literature review. Occasional Paper Series. European Central Bank.
- Graham, J. R. & Harvey, C. R. (2001). The theory and practice of corporate finance: evidence from the field. *Journal of Financial Economics*, 60, 187-243.
- Harford, Jarrad, & Vahap B. Uysal (2014). Bond market access and investment, *Journal of Financial Economics*, 112, 147–163.
- Jung, B., Naomi, S., & Sunny Yang, Y. (2013). Earnings smoothing activities of firms to manage credit ratings, *Contemporary Accounting Research*, 30, 645–676.
- Kao, C., & Hwang, S., (2008). Efficiency decomposition in two- stage data envelopment analysis: An application to non-life insurance companies in Taiwan. *European Journal of Operational Research*, 185, 418-429.
- Kisgen, D. J. & P. Strahan (2010). Do Regulations Based on Credit Ratings Affect a Firm’s Cost of Capital?, *Review of Financial Studies*, 23 (12), 4324-4347.
- Kisgen, D. J. (2006). Credit Ratings and capital Structure. *Journal of Finance*, 61, 1035-1072.

- Kisgen, D. J. (2009). Do firms target credit ratings or leverage levels?, *Journal of Financial and Quantitative Analysis*, Forthcoming, Electronic version available at <http://ssrn.com/abstract=686227>
- Kronwald, C. (2009). *Credit Rating and the Impact on Capital Structure*. Norderstedt, Germany: Druck und Bindung.
- Kueng, P. (2000). Process Performance Measurement System. *Total Quality Management*, 11(1).
- Lombardi P, Lami IM & Bottero M (2007). Application of the Analytic Network Process and the Multi-modal framework to an urban upgrading case study. In *International Conference on Whole Life Urban Sustainability and its Assessment*, 27-29 June 2007, Glasgow, UK.
- Michelsen, M. & Klein, C. (2011). The relevance of external credit ratings in the capital structure decision-making process. University of Hohenheim.
- Mitto, U.R., & Z. Zhang (2008). The Capital Structure of Multinational Corporations: Canadian versus U.S. Evidence, *Journal of Corporate Finance*, 14, 706-720.
- Neaupane K M & Piantanakulchai M (2006). Analytic network process model for landslide hazard zonation. *Engineering Geology*, 85, 281-294.
- Niemura M., & Saaty, T. (2004). An analytic network process model for financial-crisis forecasting. *International Journal of Forecasting*, 20, 573 – 587.
- Piantanakulchai, M. (2005). Analytic network process model for highway corridor planning. In *Proceeding of the International Symposium on the Analytic Hierarchy Process*, 8-10 July 2005, Honolulu, Hawaii, USA.
- Pottier, S. & D.Sommer. (1997). Agency theory and life insurer ownership structure. *Journal of Risk and Assurance*, 64, 529-543.
- Pottier, S.W. (1998). Life Insurer Financial Distress, Best's Ratings and Financial Ratios, *The Journal of Risk and Insurance*, 65, 275–88.
- Pottier, S.W. (1997). Life Insurer Risk Characteristics and the Rating Process, *The Journal of Insurance Issues*, 20, 111–30.
- Promentilla M, Furuichi T, Ishii K & Tanikawa N (2006). Evaluation of remedial countermeasures using the analytic network process. *Waste Management*, 26, 1410-1421.
- Saaty, Thomas L. (2005). *Theory and applications of the analytic network process : decision making with benefits, opportunities, costs, and risks*. WS publications, Pittsburg.
- Shahroudi. K, Taleghani. M, & Mohammadi. G. (2012). Application of Two-Stage DEA Technique for Efficiencies Measuring of Private Insurance Companies in Iran”, *International Journal of Applied Operational Research*, 1 (3), 91-104.
- Ulutas, BH (2005). Determination of the appropriate energy policy for Turkey. *Energy*, 30, 1146- 1161.
- White, L. J. (2010). Markets: the credit rating agencies. *The Journal of Economic Perspectives*, 24, 211-226.