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A Fuzzy AHP Analysis for Regulating the Factors on NPAS in Indian Banks

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Abstract

Nonperforming Assets (NPAs) in banking participates a decisive role in economies. As a financial institution that directs the market and savings, the recital measurement of the bank concerns special divisions of the society. The most important principle of the learning is to present resolution support for decision makers about the performance of NPAs in Indian Bank's through multi criteria decision making techniques. In according with this purpose, the bank performances of five regulating factors are evaluated in terms of NPAs financial performance indicator by utilizing Fuzzy Analytic Hierarchy Process (Fuzzy AHP) method. In this paper, we proved that the proposed regulating factors are effective to monitor NPAs of the banking sectors.

Keywords: Fuzzy AHP, NPA performance, multi criteria decision making.

1. Introduction

The banks are profitable association and the chief business of banking is to gather the deposits from the community and loan it to the persons, business anxieties, organization etc [1,2]. The loaning business is connected with jeopardy. One of the dangers in lending is the likelihood of account flattering nonperforming assets [3,4]. NPAs do not make interest profits and reimbursement of loan to bank does not take place according to refund agenda distressing returns of the bank and their by productivity. NPAs do not produce interest but at the same time they need banks to create stipulation for such non-performing assets out of their present profit. The term NPAs figured in the Indian banking sector after foreword of financial sector reforms in 1992 [5,6]. The prudential standards on income gratitude, assets categorization and provisioning thereon are executed from the financial year 1992-93, as per the suggestion of the Narsimham commission on the Financial System [7,8]. These standards have fetched in quantification and impartiality into the appraisal and provisioning for NPAs. Reserve Bank of India continuously deeds to make certain that instructions in this regard are close to international standards [9,10].

The principle of this study is to suggest a fuzzy AHP performance assessment models for NPAs in banking sector [11,12]. Under the growing indecision and competition in global financial markets, measurement of these fuzzy techniques gives obvious and consistent information. The evaluation of NPAs performance assists investors in building investment choices as well as generous information about banks. In the literature studies exercise multiple criteria decision making models are used to assess the financial performance of the banking sector[13,14]. Dissimilar from the widespread literature, we employ fuzzy AHP models discretely accordingly, it is obvious that fuzzy AHP model can be employed individually to measure or regulate the NPAs financial performance of banking sector.

2. Objectives

1. Measurement of risk through credit ranking / achieving;
2. Quantifying the risk through estimating predictable and unpredicted loan losses
3. Risk pricing on a methodical basis; and
4. Controlling the risk through successful Loan appraisal apparatus and portfolio management.
5. Robust credit risk management system is highly responsive and approachable to different factors disturbing the credit risk.

3. Materials and Methods

The data composed is primarily secondary in nature. The sources of data for this article comprise the literature in print by Indian Banks and the Reserve Bank of India from 1997-2015, different magazines dealing with the existing banking

scenario and research papers. Now we use MCMD in fuzzy AHP to evaluate the regulating factors of NPA in banks and then undertake a comprehensive evaluation of the factors. We shall use a numerical illustration to show our method.

4. Literature Review

1. Fuzzy

Existing approaches for fuzzy analytic hierarchy process (FAHP) method as the decision sustain system to assist decision makers building improved options together in relation to solid criteria and ethereal criteria[23,32].New hybrid fuzzy AHP replica is a suitable tool to resolve the decision-making problems in an unsure and multiple-criteria atmosphere[13].Fuzzy AHP weight derivation can be divided into two sorts, one of which is to obtain a set of fuzzy weights from a fuzzy pairwise comparison matrix, while the other is to receive a set of brittle weights from a fuzzy pairwise comparison matrix. The looms for obtaining fuzzy weights from fuzzy pairwise comparison matrices mostly comprise the geometric mean process[24], fuzzy logarithmic least-squares methods (LLSM) [23,15,30], Lambda–Max methods [19,28,29] and the linear goal programming (LGP) method [26]. The approaches receives the brittle weights from fuzzy pairwise comparison matrices which comprise the extent analysis [12] and the fuzzy preference programming (FPP) is based on nonlinear method [31].

2. Non-Performing Assets

" Reducing NPA's " The author is thus seriously observing huge blockade of the funds in NPA's which on analysis exposed the looseness in the credit practices and management of the Banks[16]. "Non Performing Assets Anomalies and Inconsistencies" written by a Bank faculty in mid 90's, The author has also very cleverly uncovered prospects of overlap in respect of Government guarantees account where procedural necessities to file claims with Government and following recovery of bad debts through legal machinery shows the methodology for reasonable and judicious provisioning amount[29].

"Assets Reconstruction Fund" addressed NPA's and capital adequacy. The author is also critical of those schools of thoughts which think that transforming of bad debt and desist for being responsible to cause recovery of bad debt. On the other hand the author had considered ARF as a needy option to save the Government from infusing the capital again and again to service mounting losses due to bad debts [34]."Rating of Banks on NPA Management" has considered all critical parameters and pertinent ratios assess branch in respect of non-performing assets. the author has come up with the idea to assign number of marks variable from parameter to parameter and aggregate sum up of marks will place their organization on scale of range between A+ (excellent) to F grade (Very poor)[35].

Though, if we seem a little future back, the asset eminence of the Indian banking system was not resembling this; it had really been civilizing appreciably since the execution of reforms in the banking sector and foreword of prudential standards, performance of the Securitization and modernization of Financial possessions and Enforcement of Security Interest Act 2002, Credit Information Companies Act, etc. The gross NPAs ratio gradually reduced from 15.7% in 1996-97 to 2.36%in 2010-11[20]. Though, the sum of NPAs observer gushes consequently and as on Mar 2015, it was at 4.62% of the gross proceeded of the banks in contrast with 2.36 per cent of the gross advances as at March 2011. The development in NPAs was much higher than the growth in advances during the last four years. In addition, the ratio of reorganized standard assets to gross advances nurtured to 6.44 % as at the end of March 2015 from 5.87 % of gross advances as on March 2014. The sum stressed assets as on Mar 2015 were 11.06 % of gross advances[21].The sharp boost in hassled assets has harmfully impacted the profitability of the banks. The yearly revisit on assets has come down from 1.09% during 2010-11 to 0.78% during 2014-15. Considering the outcome, it has on together assets and liquidity position place of the bank and there is an vital requirement for banks to decrease their strained capitals and to clean up their balance sheets lest they become a haul on the financial system. In June 2016 percentage of gross NPA was6.97 [22].

Managing asset value is always a significant and becomes an important objective during an era of financial downturn. Recognizing the magnitude of successful asset quality management, Reserve Bank has concerned different guidelines to banks, from time to time, on various features of asset quality management. The factors that contribute to the occurrence of NPAs are to highlight the applicability of fuzzy analytical hierarchy process (fuzzy-AHP) model in prioritizing the factors contributing to the occurrence of NPAs [36,37].

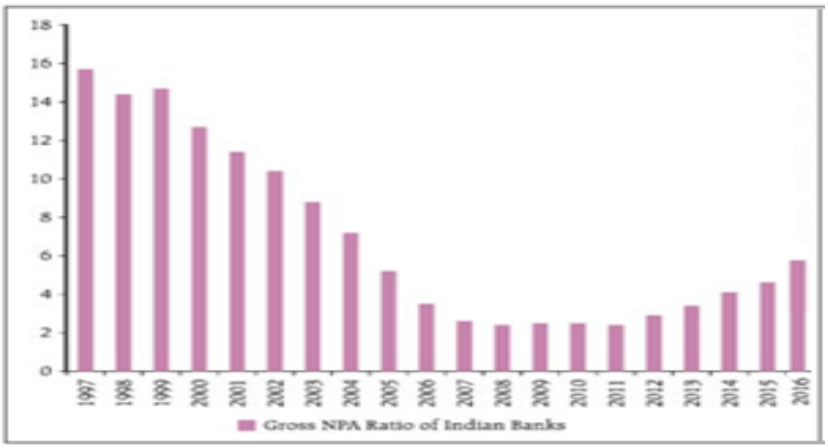

Figure 1: Gross NPA ratio of Indian Banks

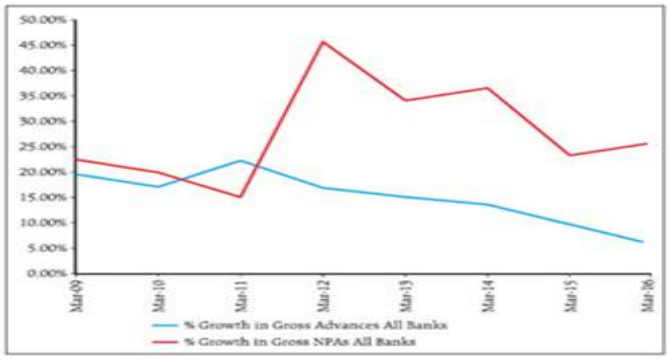

Figure 2: Growth in Gross NPAs All Banks

FUZZY System

A fuzzy system is to quantify the logical linguistic form [3] by using fuzzy logic and the mathematical functional model [1,2].

As usual the mathematical description can be a mathematical formula such as a functional relates the inputs to the outputs in the form

$$\begin{cases} y_1 = f_1(x_1,\ldots,x_n), \\ \vdots \\ y_m = f_m(x_1,\ldots,x_n); \end{cases} \quad \text{----------1}$$

or a set of differential equations in the form,

$$\begin{cases} y_1 = g_1(x_1,\ldots,x_n,\dot{x}_1,\ldots,\dot{x}_n), \\ \vdots \\ y_m = g_m(x_1,\ldots,x_n,\dot{x}_1,\ldots,\dot{x}_n); \end{cases} \quad \text{----------2}$$

or a logical linguistic statement in the form

IF (input x_1) AND….AND (input x_n)
THEN (output y_1) AND…AND(output y_m)----------3

Fuzzy AHP for Multi Criteria Decision Making (MCDM)

Among the different methodologies used, it had been observed that Fuzzy-AHP method was used extensively in decision making. The way was employed to choose the best bridge edifice method among the substitutes avoiding the discrepancy [18,19]. Fuzzy-AHP has been extensively worn in solving several complex decision making problems [20]. In our study, we use Chang's (1996, 1999) extent analysis method to regulate and evaluate the NPA's performance in banks.

The Multi criterion Decision-Making (MCDM) is a potential tool for scrutinizing complex real problems due to its intrinsic ability to judge different

alternatives (Choice, strategy, policy, scenario can also be used synonymously) on different criteria for possible selection of the suitable alternatives.

These alternatives may be further explored in-depth for their final implementation. Decision making dilemma is a procedure of choosing the most suitable one among the all suitable alternatives. In this type of tribulations, it is ordinary to judge different criteria's from different substitutes [15,16]. In such cases decision maker covet to answer multi criteria decision making problem. MCDM problem can be stated as follows:

$$D = \begin{array}{c} \\ A_1 \\ A_2 \\ \vdots \\ A_m \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \cdots & C_n \end{array} \\ \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \end{array}$$

$$W = \{w_1, w_2, \ldots, w_n\}$$

In this matrix, A1,A2,…,Am are probable alternatives which decision makers must choose; C1,C2,…,Cn signify alternative criteria of w. There are two looms to resolve multi criteria decision making problem. MCDM techniques offer profits for evaluators in terms of assessing different alternatives in diverse units and from the outlooks of diverse criteria [17]. This is a significant benefit when we evaluate with the traditional decision sustain techniques in which all the criterion are distorted in line with one unit. In totalling MCDM offers a benefit through using quantitative and qualitative valuation methods together [3,33].

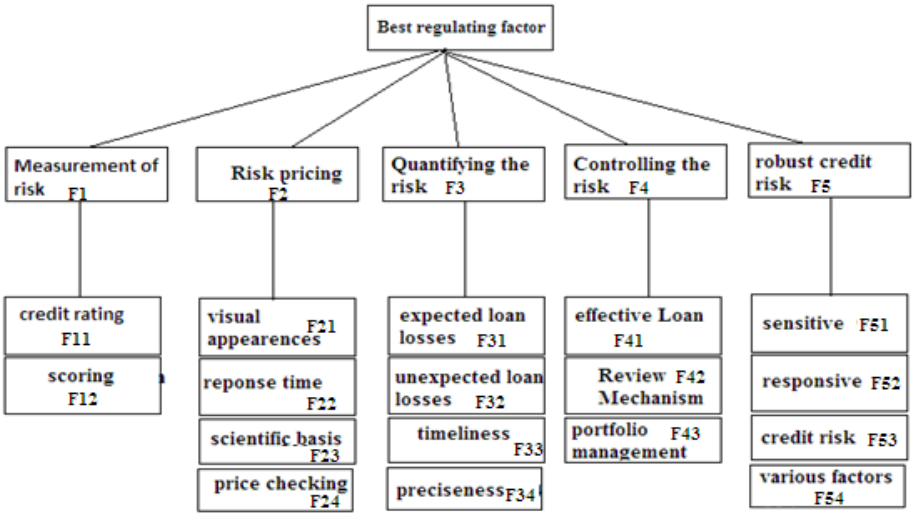

Figure 3: The Hierarchy Model of Evaluation

To Evaluate regulating factors of NPA, we use MCDM in fuzzy AHP to evaluate the regulating factors of NPA in Indian banks and then undertake a comprehensive evaluation of the factors. We shall use a numerical illustration to

show our method. First, we set up the analytic hierarchy model of evaluation as the following:

Next, we give the fuzzy confusion matrixes of the criteria level and sub-criteria level. For instance, Tables 1-7 show the original fuzzy pair-wise confusion matrixes for regulating factors evaluation.

Table 1: Fuzzy Confusion Matrix at Criteria Level

	F1	F2	F3	F4	F5
F1	0.5	0.8	0.6	0.5	0.9
F2	0.2	0.5	0.4	0.3	0.4
F3	0.3	0.6	0.5	0.3	0.7
F4	0.5	0.9	0.7	0.5	0.7
F5	0.2	0.6	0.3	0.2	0.5

From the table1, it is clear that the factors are evaluated exactly at the level of 0.5 as fuzzy value. So the other factors which have high influence in each factor and the measurement of risk is misclassified in various levels. It is predicted as risk pricing at 0.2, quantifying the risk at 0.3, controlling the risk at 0.5 and robust credit risk at 0.2 values. The factor 2 (F2), risk pricing is made with wrong prediction of 0.8 as measurement of risk, 0.6 as quantifying the risk, 0.9 as controlling the risk and 0.6 as robust credit risk. Quantifying the risk is misclassified as measurement of risk in 0.6, risk pricing in 0.4, controlling the risk in 0.7, robust credit risk in 0.3 values and controlling the risk is predicted wrongly with a value of 0.5 as measurement of risk, 0.3 as risk pricing and quantifying the risk, and 0.2 as robust credit risk. Similarly robust credit risk is misinterpreted as a measurement of risk at 0.9, risk pricing at 0.4, quantifying the risk and controlling the risk at 0.7 values. So the maximum similarity takes place in data under the factor F4 and F1, F1 and F2, F3 and F2,F4 and F2, F5 and F2, F1 and F3, F4 and F3, F1 and F5, F3 and F5, F4 and F5.

Table 2: Fuzzy Confusion Matrix at Sub-Criteria Level for Criterion C_1

	F11	F12
F11	0.5	0.6
F12	0.3	0.5

Table 3: Fuzzy Confusion Matrix at Sub-Criteria Level for Criterion C_2

	F21	F22	F23	F24
F21	0.5	0.6	0.6	0.4
F22	0.4	0.5	0.6	0.3
F23	0.3	0.4	0.5	0.2
F24	0.6	0.7	0.4	0.5

In table 2, scoring is predicted as false positive at the level of 0.3 and credit

rating is predicted as false negative at the level of 0.6. In table3, visual appearance misclassified as response time, scientific and price checking, but the misclassification rate between visual appearance and price checking is high (0.6). In case of response time prediction, the highest mis-prediction level is 0.7 for price checking. In scientific basis, it highly misclassified with visual appearance and response time (0.6).

Table 4: Fuzzy Confusion Matrix at Sub-Criteria Level for Criterion C_3

	F31	F32	F33	F34
F31	0.5	0.2	0.6	0.3
F32	0.8	0.5	0.9	0.6
F33	0.3	0.1	0.5	0.1
F34	0.6	0.4	0.8	0.5

Table 5: Fuzzy Confusion Matrix at Sub-Criteria Level for Criterion C_4

	F41	F42	F43
F41	0.5	0.7	0.4
F42	0.3	0.5	0.4
F43	0.3	0.6	0.5

Table 6: Fuzzy Confusion Matrix at Sub-Criteria Level for Criterion C_5

	F51	F52	F53	F54
F51	0.5	0.2	0.7	0.5
F52	0.7	0.5	0.6	0.7
F53	0.3	0.3	0.5	0.4
F54	0.5	0.4	0.6	0.5

In table 4, 5 and 6, the true positive prediction rate is 0.5 fuzzy values. Table 4 shows different misclassification rates which falls between 0.1 and 0.9. The maximum value is between expected loan losses (F31) and unexpected loan losses (F32) (0.8), expected loan losses (F31) and preciseness (F34) (0.6), timeliness (F33) and expected loan losses (F31) (0.6), timeliness (f33) and unexpected loan losses (F32) (0.9), timeliness (F33) and preciseness (F34) (0.8), and preciseness (F34) and timeliness (F33) (0.6). Table 5 shows the decision making between various actors under controlling the risk, where review mechanism (F42) and effective loan (F41) having maximum misclassification rate of 0.7. It follows 0.6 between review mechanism (F42) and portfolio management (F43). In table 6, it identifies the fuzzy value for predicting various factors under robust credit risk. The fuzzy value between sensitive (F51) and responsive (F52), credit risk (F53) and sensitive (F51), various factors (F54) and responsive (F52) are high (0.7) so the chance for misclassification is high between these factors.

Table 7: Priority and Consistency Ratios

APPLYING FUZZY AHP TO EVALUATE FACTORS

Criterion	Priority of criterion	Sub-criterion	Priority of sub-criterion	final Priority of sub-criterion	CR of Sub-criterion	CR of Criterion
F1	0.317	F11	0.7	0.026	0	0.05
		F12	0.3	0.111		
F2	0.06	F21	0.2	0.014	0.111	
		F22	0.2	0.011		
		F23	0.1	0.007		
		F24	0.4	0.317		
F3	0.2	F31	0.146	0.022	0.095	
		F32	0.497	0.076		
		F33	0.062	0.009		
		F34	0.31	0.042		
F4	0.06	F41	0.470	0.166	0	
		F42	0.207	0.072		
		F43	0.31	0.11		
F5	0.34	F51	0.193	0.013	0.049	
		F52	0.427	0.029		
		F53	0.160	0.011		
		F54	0.210	0.01		

We can observe that the indispensable factors distressing the achievement of NPA are factors $F1$ and $F4$; while $F11$ is the most critical factor inside$F1$ and $F41$ is the mainly decisive factor in$F4$. Let the evaluation ranking set be: Very good, Good, Moderate. We can give priority ranking weights to the elements of the evaluation set as, respectively, 100, 80, 60, 40, and 20.

Table 8: Evaluation Matrix for Regulating Factors of NPA

Criterion	Very Good	Good	Moderate
F11	0.6	0.1	0.2
F12	0.5	0.4	0.1
F21	0.1	0.6	0.3
F22	0	0.3	0.4
F23	0	0.5	0.1
F24	0.7	0.2	0.2
F31	0.6	0.1	0.2
F32	0.4	0.3	0.2
F33	0.8	0.2	0
F34	0.7	0.2	0.1
F41	0.6	0.3	0.1
F42	0.4	0.1	0.4
F43	0.3	0.3	0
F51	0	0.3	0.2
F52	0.2	0.2	0.3
F53	0	0.2	0.6
F54	0	0	0.4
Result	0.52	0.24	0.14

This result shows our method is effective to regulate the NPAs in the banking sectors. Our proposed Model MCDM in Fuzzy AHP proves it's unique in the regulating factors of NPAs.

5. Conclusion

The Proposed fuzzy multi criteria decision making is newly applied to reduce the growth of NPAs in Indian banks. While hierarchy model of evaluation helps to regulate and measure the performance in a hierarchical structure through pairwise comparison matrix. The results achieved int his paper shows that the proposed model can successfully regulate the NPAs in the banking sector.

For future studies, the performance of different fuzzy multi criteria decision making approaches can be compared. Similarly, different methods can be compared by using skewed fuzzy numbers to decrease uncertainty.

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