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Financial Risk Assessment and Management by Banks: Evidences from Past Research

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Abstract: Financial soundness of banking sector is certainly spine of every economy. Failure of giant banks devastates not only the domestic economy but it also puts the globe at stake. The best example of this is collapse of Lehman brothers in 2008. In this milieu, it is very crucial to investigate the financial soundness of domestic banks. New economic policy, 1991 have significantly changed the facade of Banking Industry in India. The banking industry has invigorated gradually from a controlled situation to a deregulated showcase economy. Banking industry is exposed to different types of risks. Risk is defined as anything that can generate hindrances in the way of attainment of certain objectives. In the present study researcher has focussed on the determinants of riskiness of the Indian banking sector and various measures taken by RBI to curb the risk. A secondary data review reveals that the Indian commercial banks are exposed to different risks such as liquidity risk, interest risk, credit risk, interest rate risk, market risk, operational risks etc. Different studies have applied different analysis techniques for assessing the riskiness such as Altman's Z Score, GAP Analysis, Data Envelopment Analysis, Tobit- Regression Model, Back Propagation Neural Network, Black Scholes-Merton option valuation, ANOVA, CAMEL Model, Sensitivity Analysis etc. The recent regulatory practices of RBI to curb such risk have been assessed. The literature review reveals that an empirical study needs to be done to analyse all the parameters affecting the banking industry. Moreover, the future research needs to be conducted in exploring alternative techniques for developing risk management scores.

1. INTRODUCTION

The growth & development of an economy depends upon the performance of its banking sector as it's the major source of finance in the economy. Ever since New Economic Policy, 1991 is introduced by Dr. Manmohan Singh there is great transformation in the Indian Banking sector. There is shift from a regulated market economy to a deregulated market economy in the banking sector. Moreover the financial crisis had a significant impact on the Indian Banking Sector. Therefore to sustain financial soundness of a bank in long run, there is dire necessity to focus on risk & distress in banking sector. Risk is prevalent in all business, so is in bank. "Risk refers to a condition where there is a possibility of undesirable occurrence of a particular result which is known or best quantifiable and therefore insurable". In the pre reform era the banks have used risk control system to adjust with the legal environment but after entering into deregulated market economy, the Indian commercial banks are

exposed to varied of types risks such as liquidity risk, operational risks, solvency risk, credit risk, interest rate risk, market risk, foreign exchange risk, etc. Therefore it's imperative to develop an effective risk management approach consisting of risk determination, risk assessment and risk minimisation. Inability to formulate such system will have negative effect on the financial soundness of business and will lead to increased probability of bankruptcy in banks. Risk management is a future oriented process, which begins with risk identification, risk estimation, risk planning, risk controlling or minimising. Through this research work, the researcher has attempted to review literature relating risk determination, risk assessment and risk minimisation. In the year 1994, The Board for Financial Supervision (BFS), a body governed by RBI has transformed reforms so as to make the Banks economically more viable & financially stronger. Since 1999, the rating of Indian banks were done using CAMELS Model & of foreign banks using CACS Model. In 1977, Altman & in 1988 Hannan&Hanweck developed Z-Score model to determine the insolvency of small scale units which was later applied to banks to judge there probability of insolvency/ bankruptcy. The Z-Score measure showed approximately 70 % accuracy giving results. As far as present scenario is concerned Data Envelopment Analysis Model & Black Scholes Merton model is used by researchers in assessing the risks of Indian Banks. The present study consist of the following sections. Section 2 describes the objective of the study. Section 3 deals with the research methodology adopted in the study. Section 4 deals with literature review relating to the risks in banking sector. Section 5 is conclusion & finding gap in the present study.

2. OBJECTIVES OF THE STUDY

The primary aim of this paper is to study the present status of riskiness & distress being exposed to banks by reviewing the past published and unpublished research work on the same topic in a well organised manner to provide quick and easy access to the future researchers of the same field. The paper is attempted to have wider knowledge of the financial risk assessment of the banks.

Another aim of the study is to divide the phase of risk into different segments such as risk assessment & evaluation, risk management and risk minimisation & to evaluate the approaches used to minimise the riskiness in the banking sector. Furthermore, suggestions are provided on the prospects of future research on the same topic.

3. RESEARCH METHODOLOGY

3.1. Data

The paper consist of extensive search of fifty research papers that have studied riskiness & distress of banks published or un published from 2000 to 2016. The classification of various papers from various sources is presented in Table 1. In Table 3A, 3B , 3C ,careful substance investigation dispassionately sorted out and coded the reviews in light of different viewpoints including distribution year, centre of study, technique embraced and the conclusion & findings discovered. Analysis of the resulting data presents an overview of the research and identifies areas for future research.

3.2. Methodology

This paper is an attempt to present a review of financial riskiness & distress of the banks, published or unpublished, from 2000 to 2016. The writing hunt depended on the catchphrase "Risk & Distress in banks" for chosen databases and sites for the period going from 2000 to 2016. The databases were scanned for the watchwords in the titles, abstracts, catchphrases records and full content. Relevant papers related to banking riskiness and distress are considered for the present study, classification of entire risk can be categorised into following segments; yearly division of research, sources from where the papers are collected and phases in literature review. This paper is a comprehensive snapshot of 50 research papers. Table 1 depicts the yearly division of research.

3.2.1. Yearly division of research

The yearly division of research is provided in below table. The table shows that

Table 1
Depicts that maximum number of the paper on the said topic were published during 2012.

<i>S. no.</i>	<i>Year</i>	<i>No. of Studies</i>
1	2016	4
2	2015	6
3	2014	6
4	2013	4
5	2012	7
6	2011	6
7	2010	3
8	2009	4
9	2008	2
10	2007	2
11	2006	2
12	2004	2
13	2000	2
Total No. of Papers		50

3.2.2. Sources from where the papers are collected

The sources from where the research papers are collected are summarised in the following table , Going through the table , it can be inferred that most of the papers are collected from referred academic research journals for the present study.

Table 2

<i>Journal Name</i>	<i>No. of Papers</i>
Journal of Business and Technology	1
Journal of Money, Credit and Banking	1
Journal of Political Economy	1
Journal of Money, Credit and Banking	2
Journal of Risk Finance	2
Journal of Financial Econometrics	1
Journal of Banking and Finance	12
International Journal of Research in Commerce, Economics and Management	1
Journal of Business and Policy Research	1
International Research Journal of Finance and Economics	2
European Journal of Economics, Finance and Administrative Sciences	2
Finance India	1
Journal of Economics	1
Journal of Financial Regulation and Compliance	1

(contd...Table 2)

<i>Journal Name</i>	<i>No. of Papers</i>
European Journal of Operational Research	4
Journal of Banking Regulation	1
Journal of Business and Policy Research	1
Journal of Finance	3
Federal Reserve Bank of St.Louis Economic Review 74	1
Financial Analysts Journal	1
Journal of Banking Regulation	1
JM International Journal of Finance	1
The IUP Journal of Bank Management	2
IJMT	1
Federal Reserve Bulletin	1
Taylor and Francis Journals	1
Sage Journal	1
International journal of financial management	1
6th Global Conference on Business & Economics	1
European Journal of Economics, Finance & Administrative Sciences	1
TOTAL	50

Table 2 shows that maximum publication relating to banking risk & distress are published in “Journal of Banking and Finance”.

4. ANALYSIS OF EARLIER RESEARCH WORK

This section deals with the break up of literature review on the basis of the focus areas of risk evaluation & assessment, risk management and risk minimisation in banking sector. Most of the studies are focusing on risk evaluation & assessment and empirical evidences on their determinants. In spite of the fact that there are studies in this field applying capital adequacy ratio, productivity & profitability, liquidity or camel rating, yet the trouble position has not broadly examined. Some of the research studies conducted in the arena during last sixteen years are briefly reviewed in Table III(A), (B), (C).

4.1. Risk Evaluation & Assessment

Table 3 shows the literature review relating to risk evaluation & assessment by researchers covering national & international scenario.

The review of literature of above papers reveals that the researchers have tried to analyse & evaluate the different parameters pertinent to credit risks. However, the reviewed paper does not cover the evaluation of the overall risks in banks & the size of the sample is also limited. Further research could deal with the analysing all the parameters of overall risk exposed to banks & study could also focus on determinants of financial risk. The future research could be based on the consideration of all types of commercial banks including private sector banks and public sector banks. Finally the study can be performed on the contribution to systemic risk. The banks should find out the measurement of marginal contribution to the overall risk. The study can focus on the interdependency or interrelationship between capital, risks and bank efficiency / profitability of the banks.

Table 3

<i>S. no.</i>	<i>Name of author, year</i>	<i>Title of paper</i>	<i>Research Methodology</i>	<i>Objective of study</i>	<i>Conclusion</i>
1.	Sinha, P., Sharma, S., & Sondhi, K. (2013).	Market Valuation and Risk Assessment of Indian Banks using Black -Scholes-Merton Model	1. Black-Scholes-Merton option valuation approach . 2. Z-score 3. Theoretical model.	To study the riskiness of banks considering its assets & equity	1. The inconsistency in assets is 3 to 5 times in the private sector banks. 2. The paper further discusses the RBI Regulations relating to risk management in banks.
2.	Aneja, R., & Makkar, A. (2013).	A Comparative study of book value in solvency of Indian commercial banks: application of Z score.	1. Z-Score Model. 2. Least square regression model.	1. To analyse & identify determinants of insolvency risks in commercial banks. 2. To study the comparison of insolvency risks among Indian banks.	1. The study reveals increase in capital adequacy and reducing non-performing assets will lead to financial soundness of banks. 2. The public sector banks are less exposed to insolvency risk.
3.	Pradhan, R. (2014).	Z Score Estimation for Indian Banking Sector	1. Z score 2. Back propagation neural networks	1. To study the terms of credit and ensure safe repayment. 2. To forecast the bank ruptcy risk of public sector banks in India.	1. The highest Z-Score value is of Oriental Bank of Commerce. 2. Thus, the priority lending must be done in the order OBC, PNB and then SBI.
4.	Aspal, P. K., & Dhawan, S. (2014)	Financial performance assessment of banking sector in India: A case study of old private sector banks	1. CAMELS rating model 2. GAP Analysis 3. Sensitivity Analysis.	1. To study the performance of private sector banks on the basis of ratios used in CAMELS model. 2. To rank the banks performance using CAMELS Model.	1. In the study using CAMELS model it is revealed that TamilNadu Bank secured first position in terms of overall composite ranking followed by Federal Bank. 2. On the basis of CAMELS criteria Tamilnadu Mercantile Bank a Federal bank has excellent financial performance. 3. On the contrary Dhanalakshmi Bank, Catholic Siyrian Bank, ING Vysya Bank and are worst performing banks in terms of financial performance.
5.	Sinha, P., Taneja, V. S., & Gothi, V. (2009)	Evaluation of riskiness of Indian Banks and probability of book value insolvency	1. Z score Statistics. 2. Probability.	1. To analyze the likelihood of bankruptcy of Indian banks'. 2. To make comparison between private and public sector banks in India.	1. The study reveals a downfall in the likelihood of insolvency of Indian Banks. 2. The public sector banks are less prone to likelihood of insolvency.

(contd...Table 3)

S. no.	Name of author, year	Title of paper	Research Methodology	Objective of study	Conclusion
6.	SantiGopal Maji, Soma Dey&Arvind Kr. Jha (2011)	Insolvency risk of selected Indian Commercial Banks: a comparative analysis	1. Z Score Model. 2. OLS model.	1. To measure the insolvency risk of Indian private sector, foreign banks& public sector banks. 2. To identify key factors affecting insolvency risk of banks.	1. Z statistic for all the bank groups shows improvement over the years. 2. Public sector banks are less exposed to risk... 3. The variability of assets should be reduced in Private sector banks and foreignbanks so as to maintain sound financial health.
7.	Das, K. C. (2012)	Banking Sector Reform and Insolvency Risk of Commercial Banks in India	1. Z-score' measure of insolvency risk 2. Panel data econometrics 3. Trend analysis	1. To analyze the insolvency risk of commercial banks.	1. The risk exposure of banks are as follows:- Private sector banks, public sector banks and foreign banks. 2. The study concludes diversifying the banks services helps in mitigating risks & Higher competitions tend to induce risk.
8.	Subramanyam, T. (2013).	Technical and risk efficiency evaluation of IndianCommercial banks using DEA models	1. Data envelopment analysis models. 2. Stochastic frontier production functions. 3. Regression Analysis	1. To identify the risk factors in Indian commercial banks.	1. The overall technical efficiency is divided into exogenous & endogenous risk, scale and pure technical efficiency. 2. The public sector banks are faced to exogenous Risk and the private sector banks are more exposed to endogeneous risks.
9.	Bandopadhyay, K., & Bandyopadhyay, S. K. (2010)	Risk Analysis of Scheduled Commercial Banks of India	1. Ratios, Mean, Standard deviation and co-efficient of variation 2. ANOVA 3. K- means Cluster analysis. 4. Mixed Effects Model. 5. Panel Data Approach.	To study the overall risk ortotal risk i.e credit risk, operational risk, liquidity risk market risk etc. of banks.	1. The co-efficient of variation& Standard deviation of NIM is more in private sector banks 2. Risk arises due to individual level operation is more prominent than the risk arises due to group level variation. 3. Economic liberalisation might have increased competition but has not led to change the level of risk.
10.	Jalan, M., &Pradhan,	Risk Based Pricing of Deposit Insurance:	1. Credit value at risk model	1. To evaluate the DICGC credit risk based on option	1. Riskiness of individual bank have decreased over

(contd...Table 3)

<i>S. no.</i>	<i>Name of author, year</i>	<i>Title of paper</i>	<i>Research Methodology</i>	<i>Objective of study</i>	<i>Conclusion</i>
	H. K. (2012).	Empirical Estimation of Commercial Banks of India		pricing models. 2. To estimate the individual default risks for the banks.	the years.
11.	Maji, S. G., & De, U. K. (2015).	Regulatory capital and risk of Indian banks: a simultaneous equation approach	1. Central Tendency, 2. Regression, 3. Z Score.	1. To examine the relationship between regulatory capital and risk of commercial banks in India and the impacts of other relevant variables on them.	1. The study reveals a strong inverse relationship between risk and capital adequacy ratio. 2. The study concludes that there is the positive influence of profitability on both capital and risk. 3. There is a significant declining trend of credit risk during the period of 2002-2008 So is the CAR and profitability (ROA).
12.	Bhagat K Gayval 1, V H Bajaj (2015)	Measuring Efficiency of Indian Banks: A DEA-Stochastic Frontier Analysis	1. Data Envelopment Analysis , 2. Stochastic Frontier Analysis, 3. Multivariate Nonlinear Model.	1. To estimate efficiency of Indian commercial banks using DEA approach & Stochastic Frontier Analysis (SFA)	1. The results suggest moderate consistency between parametric and nonparametric frontier methods in efficiency measuring.
13.	SHARMA, N. (2013).	Altman model and financial soundness of Indian Banks	Altman Z score model	1. To analyse the distress in Indian banks through testing the Altman model.	1. The two banks found somehow in distress position are Canara bank among public sector banks and Kotak Mahindra bank among private sector banks.
14.	Singh, D. N. (2011).	A comparative study of risk parameters of banks in India	Ratio analysis	1. To study the varied types of risk faced by banking sector. 2. To measure the degree of risk faced by different banks.	1. The Public Sector are less exposed to risks.
15.	Murari, K. (2012).	Insolvency Risk and Z-Index for Indian Banks: A Probabilistic Interpretation of Bankruptcy	Z-Index along with the probability	1. To evaluate the insolvency risk in commercial banks of India.	1. There is decrease in the insolvency risk of Indian banks from last few years. 2. The public sector banks are less exposed to insolvency risk in comparison to foreign & private sector banks.
16.	Agarwal, N., Guha,	Performance measurement of Indian	1. DEA—VRS Model, 2. CAMEL Model.	1. To measure efficiency level of Indian banks using	1. Among the private sector banks, ICICI Bank is

(contd...Table 3)

S. no.	Name of author, year	Title of paper	Research Methodology	Objective of study	Conclusion
	B., Dutta, A., & Bandyopadhyay, G. (2014).	banks using data envelopment analysis		data envelopment analysis (DEA) based on the performance of Indian banks and its stock market return. 2. To make overall comparison of performance of Indian banks.	most exposed to risk and in public sector banks SBI and BOI were most SBI and BOI were most inefficient hence more prone to risk.
17.	Subramanyam, T., & Reddy, C.S. (2008).	Measuring the risk efficiency in Indian commercial banking - a DEA approach	1. DEA Model.	1. To analyse & evaluate risk in Indian commercial banks using DEA.	1. There is a need to strengthen the internal risk control system in private sector banks. 2. Foreign banks are less exposed to risks.
18.	Singh, R. I. (2015).	Explanatory variables of credit risk: an empirical study of Indian banking industry	1. Levene's test, 2. Welch one way anova, 3. Turkey post hoc and 4. Multiple Linear Regression model. 5. Percentage of NPA to advances	1. To examine the factors affecting credit risk in the Indian banking industry.	1. Advances, Consumer Price Index and Sensex level were found to be the major factors affecting NPAs of the Indian Banking Industry. 2. Private Sector Indian Banks were found comparatively better in the management of credit risk as compared to Public Sector Banks.
INTERNATIONAL SCENARIO					
19.	Ashraf, A., & Tariq, Y. B. (2016).	Evaluating the financial soundness of banks: An application of bankometer On Pakistani listed banks	1. Bankometer Model, 2. Z-Score Model, 3. Ratio Analysis.	1. To evaluate the financial soundness of banks using bankometer . 2. A comparison is made between bankometer & Z-Score .	1. The results states that as per both models Bank of Punjab's financial soundness needs to be improved.
20.	Manta, A., & Badircea, R. (2015).	The relationship between efficiency, capital and risk from the banking activity perspective	1. Regression & Correlation. 2. Least square method. 3. Panel model in Eviews. 4. DEA Model.	1. To study the determinants of the banking risk. 2. To study effect of risk on the profitability & efficiency of banks.	1. The main determinant of bank risk is non-performing assets. 2. Higher non performing assets indicates high inefficiency level in the banks.
21.	Poudel, R. P. S. (2012).	The impact of credit risk management on financial performance of commercial banks in Nepal	Correlation and regression	1. To study determinants of credit risk management in banks. 2. To study the effect of credit risk management on financial performance of banks.	1. The study reveals that banks can attain better performance & reduce risk by maintaining optimum level of capital adequacy & by allocating more funds to default rate management.
22.	Ta-Cheng, C., & Yung	Affecting factors on risk-adjusted efficiency	1. To estimate bank cost efficiency - DEA MODEL.	1. To study the bank efficiency index and	1. The risk directly impacts bank efficiency.

(contd...Table 3)

<i>S. no.</i>	<i>Name of author, year</i>	<i>Title of paper</i>	<i>Research Methodology</i>	<i>Objective of study</i>	<i>Conclusion</i>
	-Ho, C. (2006).	ciency in taiwan's banking industry	2. To estimate efficiency effects-tobit regression model	market risk.	2. The bank productivity changes significantly without hazard or with credit as well as market dangers.
23.	Lopez, J. A., & Saidenberg, M. R. (2000).	Evaluating Credit Risk Models	1. Panel data approach, 2. Simulation Technique, 3. Time series Analysis.	1. To assess the precision of a model's conjectures of credit losses. 2. To evaluate methods for credit risk models	1. The study reveals that evaluation of credit risk models is difficult in comparison to the market risk models.
24.	Rahman, A., Ibrahim, M., Meera, A. K. M., & Kameel, A. (2009).	Lending structure and bank insolvency risk: a comparative study of Islamic & conventional banks.	1. Linear Model (using generalized least squares) 2. Panel Data, 3. Likelihood Ratio & Hausman Test, 4. Park's Model/ Regression Model 5. Variance of Traditionality Index (VART) 6. Specialized Index (SPEC) 7. Lending Composition Change (LCC)	1. To compare the insolvency risk of the conventional & Islamic banks .	1. The study reveals that the conventional banks' are directly affected by real estate lending. 2. The Islamic banks's are not affected by the real estate lending.
25.	Yamin, I. Y., & Ali, M. M. S.	Evaluating the financial soundness of Jordanian Commercial banks by applying Bankometer's Model.	1. Bankometer Model, 2. Z-Score Model, 3. Ratio Analysis.	1. To analyse the financial soundness of Jordanian Commercial banks.	1. The study reveals that the bank Al-Ethiad has the transparent policies. 2. Almost all the banks have sound financial position.
26.	Ahmad, S. (2006).	Banking Risk and Efficiency: An Evidence from Commercial Banks of Pakistan	1. Stochastic cost frontiers 2. Log Likelihood Ratio Test	1. To concentrate the effect of hazard and quality components on banks cost structure. 2. To explore the effect of risk and quality elements on the execution of business banks in Pakistan. 3. To assess effectiveness and specialized change of the keeps money with and without hazard and quality variables.	1. The study reveals that banks are more efficient if they possess less riskier assets. 2. The results depicts risk does not affect the efficiency level of banks.
27.	Yap, V. C., Ong, H. B., Chan, K. T., & Ang, Y. S. (2010).	Factors Affecting Banks' Risk Exposure: Evidence from Malaysia	1. Factor Analysis	1. To identify the determinants of risks faced by commercial banks in Malaysia.	1. The study shows that banks risk exposure are affected by liquidity position, domestic market, international market, business operation and credit.

(contd...Table 3)

<i>S. no.</i>	<i>Name of author, year</i>	<i>Title of paper</i>	<i>Research Methodology</i>	<i>Objective of study</i>	<i>Conclusion</i>
28.	Ahmad, N. H., & Ahmad, S. N. (2004).	Key factors influencing credit risk of islamic bank: a Malaysian case	1. Regression Analysis.	1. To examines various factors affecting credit risk, in in Malaysia.	1. The discoveries demonstrate that administration productivity, chance weighted resources and size of aggregate resources have critical impact using a loan danger of Islamic keeping money, while traditional managing an account credit hazard are essentially influenced by advance introduction to unsafe Areas, administrative capital, credit misfortune arrangement and hazard weighted resources. 2. Measures are suggested to increase efficiency and reduce the credit risk in Islamic banks.
29.	Miah, M. D., & Sharmeen, K. (2015).	Relationship between capital, risk and efficiency.	1. Stochastic Frontier Analysis. 2. Seemingly Unrelated Regression (SUR) approach	1. To study the relationship between capital, risk and efficiency of Islamic and conventional banks in Bangladesh	1. The study reveals negative relation between capital and efficiency. 2. A positive relation exists between capital and risk for Islamic banks. 3. A positive relation exists between risk and efficiency for Conventional banks.

4.2. Risk Management

Table 3B shows the literature review relating to risk management by researchers covering national & international scenario.

The review of literature of above papers reveals that most of the aspects of risk management are covered by the researchers. The future studies can emphasise more on analysing in detail the credit risk management & liquidity risk management as they have a direct impact on the continuity of commercial banks. The weak status of credit risk and liquidity risk would lead to the liquidation of commercial banks. It may also focus on Basel II and risk management, one of the vital topics in the banking industry. Furthermore the research could be done taking into consideration all the micro & macro factors, focusing on both the qualitative & quantitative risk assessment so as to have holistic view regarding the riskiness in banks & its management. Finally, the study could usefully be conducted in different country, using the same methodology as it will provide with varied results because the risk management practices are the effects of different factors such as economic conditions, competition and regulations.

Table 3B

<i>S. no.</i>	<i>Name of author, year</i>	<i>Title of paper</i>	<i>Research Methodology</i>	<i>Objective of study</i>	<i>Conclusion</i>
1.	Aneja, Suksham R and Kapoor, Bhisham and Pahuja, Anurag (2015)	Risk Management in Indian Banks: An Evaluation through Z Risk Index	Z-Index statistics	1. To measure Z Risk index for public, private and selected foreign banks operating in India during the period of 2006-2014. 2. To break down the effect of size and responsibility for on the scope of operational hazard administration.	1. Z-Risk index predicts that the Insolvency risk of the public sector banks is less as compared to private and foreign banks. 2. Financial health of banks can be improved by reducing the variability of ROA which represents the risk.
2.	Narayana, A., & Mahadeva, K. S. (2016).	Risk Management in Banking Sector - An Empirical Study	1. GAP Analysis 2. Value at Risk (VaR) 3. Sensitivity Analysis 4. Risk Adjusted 5. Rate of Return on Capital (RAROC) 6. Securitization 7. Sensitivity Analysis 8. Internal Rating System	1. To determine the riskiness in banking. 2. To trace out the process of risk management. 3. To study the tools of reducing riskiness in banking .	1. The study suggests the risk management should be focused on specific bank considering the size and quality of balance sheet, 2. Further the study states that many committees handle the risk such as Risk Management Committee, Credit Policy Committee, Asset Liability Committee, etcare such aspects. 3. Finally,two important determinants of risk management are found to be internal rating system and risk adjusted rate of return on capital.
3.	Mehra, Y. S. (2012).	Operational risk management in Indian banks: issues & challenges	1. Factor Analysis	1. To break down the effect of size and responsibility for on the scope of operational hazard administration.	1. Its important for the banks to develop an ORM Culture in banks.
INTERNATIONAL SCENARIO					
4.	Hassan Al-Tamimi, H.,A., & Faris, M. A. (2007).	Banks' risk management: a comparison study of UAE national and foreign banks	1. Reliability - Cronbach's alpha Hypothesis testing-one-way ANOVA and regression analysis.	1. To study therisk and risk management practices followed by the UAE national and foreign banks.	1. In UAE banks are exposed to foreign exchange risk, followed by credit risk, then operating risk. 2. The UAE banks have risk management system.
5.	Hameeda, A. H., & Al-Ajmi, J. (2012).	Risk management practices of conventional and Islamic banks in Bahrain	1. ANOVA 2. Multicollenearity 3. t-test.	1. To study the risk and risk management practices followed in Bahrain. 2. To make comparison of RMPs of conventional and Islamic banks.	1. In Bahrain, Islamic banks are exposed to credit risk, followed by liquidity and operating risk. 2. The Islamic banks have an effective risk management strategy.

(contd...Table 3B)

S. no.	Name of author, year	Title of paper	Research Methodology	Objective of study	Conclusion
					3. The Islamic banks are more risk prone IN comparison to convectional banks.
6.	Sensarma, R., & Jayadev, M. (2009).	Are bank stocks sensitive to risk management	<ol style="list-style-type: none"> 1. "Multivariate statistical techniques of factor analysis for developing risk management scores. 2. Discriminant analysis technique to develop Z scores of risk management for banks. 3. Regression analysis to investigate the stock market response to these risk management scores." 	<ol style="list-style-type: none"> 1. To sum up bank financial statements on its risk management capabilities. 2. To ascertain the sensitivity of bank stocks to riskmanagement. 	<ol style="list-style-type: none"> 1. Line of descent returns respond positively to risk direction capabilities. 2. The subject field suggest that those banks that have better risk management capableness reward stockholder with enhanced wealth.
7.	Nair, G. K., Purohit, H., & Choudhary, N. (2014).	Influence of Risk Management on Performance: An Empirical Study of International Islamic Bank	<ol style="list-style-type: none"> 1. Multiple regression analysis, 2. Mean & Standard deviation, 3. Skewness and Kurtosis 4. t-test 	<ol style="list-style-type: none"> 1. To study the relevance of risk management in the context of business performance of International Islamic Banks. 2. To study the mathematical relationships between variables of interest and business performance. 	<ol style="list-style-type: none"> 1. The study reveals that risk management significantly influences business performance. 2. The risk assessment analysis should be based on all potential losses.

4.3. Risk Minimisation

Table 3C shows the literature review relating to risk minimisation techniques explored by researchers covering national & international scenario.

Table 3C

S. no.	Name of author, year	Title of paper	Research Methodology	Objective of study	Conclusion
1.	Reddy, C. S., & Subramanyam, T. (2011).	Data Envelopment Analysis Models to measure risk efficiency : Indian commercial banks	<ol style="list-style-type: none"> 1. Data Envelopment Model 2. standard deviation 3. mean 4. coefficient of variation 	<ol style="list-style-type: none"> 1. To develop a four-stage Data Envelopment Analysis (DEA) to decompose multiplicatively the overall input technical efficiency into input pure technical efficiency, exogenous risk, endogenous risk and scale efficiency; and 2. To implement the decomposition to measure exogenous and endogenous risk efficiency of 	<ol style="list-style-type: none"> 1. Interest rate, market, competition and operational risks all contribute to NPAs. 2. The public and private sector banks functioned alike experiencing more input losses due to endogenous than exogenous risk inefficiency. 3. The private sector banks are found as vulnerable as the public sector banks

(contd...Table 3C)

<i>S. no.</i>	<i>Name of author, year</i>	<i>Title of paper</i>	<i>Research Methodology</i>	<i>Objective of study</i>	<i>Conclusion</i>
				Indian commercial banks.	to shocks caused by internal and external non-discretionary risk factors. 4. The foreign sector banks faced marginal input losses due to not only exogenous but also endogenous risk inefficiency. 5. The risk environment envisaged in foreign sector banks is very different from that of public and private sector banks. 6. The private sector money box are more scale efficient in comparison to the foreign & public sector banks.
2.	Kumar, M. N., & Rao, V. S. H. (2015).	A New Methodology for Estimating Internal Credit Risk and Bankruptcy Prediction under Basel II Regime	1. Multivariate Nonlinear Model, 2. Discriminate Analysis, 3. Altman's Z-score,	1. To formulate advanced multivariate non linear model for computing the Z-score.	1. A Multivariate Discriminate Analysis (MDA) is proposed which shows 5% more accuracy than the Z-Score for predicting the bankruptcy index.
3.	Dhar, S. K. (2013).	Enterprise Risk Managements in Indian Banks	1. Correlation coefficient,	1. To analyze and classify the different forms of risks faced by the banking industry. 2. To examine the adequacy of existing Basel norms in managing risks. 3. To study the problems faced by the Indian banks in implementing the risk mitigating policies and tools.	1. Risk management is compliance driven in Indian banks and not strategy driven.
4.	Sentana, J. T. (2009).	Modeling and Empirical Validation of Revised Altman's Credit Risk Model for Indian Banks	1. Multiple Discriminant Analysis (MDA) 2. KMV Model 3. Altman's Model 4. Logit Model 5. Linear Probability Model.	1. To design an internal credit rating model for banks. 2. The study aims at validating the efficiency of Altman's Z Score model for credit risk evaluation.	1. An advanced Altman's model was designed to predict default one year prior with an accuracy of over 80%.
5.	Balakrishnan, C. (2008).	Interest rate risk measurement in indian banking industry –	Gap Analysis Technique	1. To measure & assess the Interest Rate Risk in the public sector banks in	1. GAP Analysis is used to measure interest rate risk & liquidity risk.

(contd...Table 3C)

S. no.	Name of author, year	Title of paper	Research Methodology	Objective of study	Conclusion
		an analytical research study		India.	2. Interest rate derivatives are used to manage asset and liability positions.
6.	Pradhan, R., Pathak, K. K., & Singh, P. P. (2011).	Z Score Reveals Credit Capacity: A Case Study of SBI	1. Z-Score 2. Back propagation neural network.	1. To determine the parameters of the Z Score.	1. The study emphasizes on the role of BPNN in computing Z Score. . 2. Further, it concludes that the tailored back propagation neural network predicts the internal parameters.
7.	Charumathi, B. (2008).	Asset Liability Management in Indian Banking Industry - with special reference to Interest Rate Risk Management in ICICI Bank	GAP Analysis Technique.	1. To measure and monitor the Interest Rate Risk in ICICI Bank using Gap Analysis Technique. 2. To measure the liquidity risk of banks.	1. The study concludes that the degree of assets liability mismatch should be controlled with increase in the size of the balance sheet.
INTERNATIONAL SCENARIO					
8.	Bessler, W., & Kurmann, P. (2012).	Bank Risk Factors and Changing Risk Exposures of Banks Capital Market Evidence Before and During the Financial Crisis	1. Time-Series 3 Factor model; Augmented Multi-Factor Model 2. Regressions ; Pooled Cross-Sectional and Tobit Regressions. 3. correlation	1. To analyze the magnitude and changes in risk exposures that are reflected in depository financial institution stock yield within the European Monetary Join (EMU) and the United State (US)	1. Interest rate risk exposure of banks has seen a dramatic reduction over our sample period. 2. Strong determinants for the return-generating summons of bank stock returns are credit risk , real estate risk, sovereign risk.
9.	Allen, D. E., Chandra, M., & Yong, J. Y. (2004).	How Bank Risk Profiles Affect Their Strength: An Assessment of Banks in the Asia-Pacific Region	1. APT Model 2. CAMEL Model 3. Sensitivity Analysis.	1. To analyses bank riskiness of Asia-Pacific banks.	1. The study suggests that banks should diversify there operations in order to ensure financial soundness..
10.	Saif h. Al zaabi, o. (2011).	Potential for the application of Z-score in UAE Islamic banks	1. Z-score' measure of insolvency risk.	1. To develop Z-score model for Islamic banks in the UAE.	1. The study suggests that the Islamic banks in the UAE are financially sound and healthy.
11.	Gordy, M.B. (2000).	A comparative anatomy of credit risk models	1. Simulation, 2. Credit Risk models, 3. RiskMetrics Group's 4. CreditMetrics and Credit Suisse Financial Product's Credit Risk.	1. To make a comparative anatomy of two for credit risk models, the Risk Metrics Group's Credit Metrics and Credit Suisse Financial Product's Credit Risk.	1. The study concluded that its difficult to measure expected default probabilities.
12.	Strobel, F. (2011).	Bank insolvency risk and different	1. Correlation, 2. Z-Score.	1. To study the extent to which Z score measures is	1. The study concludes that the different approaches

(contd...Table 3C)

<i>S. no.</i>	<i>Name of author, year</i>	<i>Title of paper</i>	<i>Research Methodology</i>	<i>Objective of study</i>	<i>Conclusion</i>
		approaches to aggregate Z-score measures: a note		effective in judging the financial soundness.	to constructing aggregate insolvency risk measures are helpful in giving true picture of financial soundness.
13.	Nimalat-hasan, b.; balaputhiran, s.; priya, k. (2012)	Evaluating the Financial Soundness Of Selected Commercial Banks In Sri Lanka: An Application of Bankometer Model	1. Bankometer Model, 2. Z-Score Model, 3. Ratio Analysis.	1. To interpret the financial soundness of the public and private sector banks in Sri Lanka. 2. To compare the financial soundness of public and private sector banks. 3. To suggest measures for solving problems.	1. The study concluded that the state banks in Sri Lanka are in better position as compared to other banks. 2. The study suggests that the private banks needs to improve their performance ratios.

The review of literature of the above papers concludes that various models have been used by different authors in order to minimise risks. The techniques to minimise risk explored by different authors are sensitivity analysis , to determine how much the valuation of an individual variable changes by varying an independent input ; Altman’s Z –Score, to determine the probability of bankruptcy in banks; Data Envelopment Analysis, to evaluate the performance of the banks ; Bankometer Model ,to analyse the financial soundness of banks; Black Scholes option Pricing Model, to analyse the market value and riskiness / volatility of bank’s assets etc. The literature further declares that that in order to improve their financial health, Indian banks need to reduce the non-performing loans to a very negligible level and maintain a steady ROA. Moreover, the future research needs to be conducted in exploring alternative techniques for developing risk management scores.

5. CONCLUSION & SCOPE FOR FUTURE RESEARCH

The study of financial soundness / distress of banking sector is totally inevitable to ensure economic growth & development. The analysis of earlier research work done reveals that since the 1980’s different researchers have been employing different approaches for evaluating , assessing , managing & minimising risk in banking industry. Most popular of all these tools were the CAMEL Model, Credit Risk Model, GAP Analysis, Sensitivity Analysis, Panel Data Approach etc. Other techniques for evaluating distress are Altman’s Z –Score, to determine the probability of bankruptcy in banks; Data Envelopment Analysis, to evaluate the performance of the banks; Bankometer Model to analyse the financial soundness of banks; Black Scholes option Pricing Model, to calculate the market value and riskiness / volatility of bank’s assets etc.

The study declares that it is imperative to analyse all the parameters i.e. the micro & macro factors, focusing on both the qualitative & quantitative risk assessment so as to have holistic view regarding the riskiness in banks .Moreover, there is a need to explore alternative techniques for developing risk management scores and expanding the present techniques.

Present paper is a compiled review comprising of references for which papers cited may be referred.

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