ORIENTAL JOURNAL OF COMPUTER SCIENCE & TECHNOLOGY
An International Open Free Access, Peer Reviewed Research Journal
www.computerscijournal.org

ISSN: 0974-6471
December 2011,
Vol. 4, No. (2):
Pgs. 317-327

Application of Artificial Neural Network in the Ratio Prediction of Axis Bank

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(Received: September 27, 2011; Accepted: November 01, 2011)

ABSTRACT

The prediction of corporate bankruptcies is an important and widely studied topic since it can have significant impact on bank lending decisions and profitability. This work presents two contributions. First we review the topic of bankruptcy prediction, with emphasis on different models. Second, Inspired by the traditional credit risk models developed, we propose novel indicators for the NN system. Thereafter, this paper using the tailored back-propagation neural network endeavors to predict the financial ratios expressing the position of a firm to regulate the bankruptcy and assess the credit risks. It first estimates the financial ratio for a firm from 2001-2008 to the train the BPNN and uses the estimates of the year 2009 and 2010 values for the validation process. Finally it dwells to draw predictions for the period 2011-2015 and emphasizes the growing role of BPNN application based prediction models for banking sector with a case study of AXIS bank. We conclude with practical suggestions on how best to integrate models and research into policy making decisions.

Key words: Artificial Neural Network, Ratio prediction, Corporate Bankruptcies.

INTRODUCTION

Bankruptcy prediction has long been an important and widely studied topic. The main impact of such research is in bank lending. Banks need to predict the possibility of default of a potential counterparty before they extend a loan. This can lead to sounder lending decisions, and therefore result in significant savings. In this study we focus only on the bankruptcy prediction problem for firms in the banking sector. Measuring the credit risk accurately also allows banks to engineer future lending transactions, so as to achieve targeted return/risk characteristics.

The focus of this article is on the application of the tailored backpropagation neural network application to check viability of credit lending using financial ratios. In the next section we give a review on the approach. Section III presents model design and methodology of using the ratios. Section IV discusses the input parameters being ratios of the ratio pillars. Section IV discusses the convergence details for the network. Section V throws light on the results and outcomes for the ratio pillars .Section VI provides the summary and conclusion of this paper.

Literature review

Experience with the recent crisis forced

the bank authorities and the central banks on the global level to draw a number of lessons. The result being the new Basel Capital Accord which enlisted guidelines that all banks should develop systematic validated methods for assessing the risks associated with lending. As a result the new rules may increase the operational security of the banks in granting the credit. They are required to establish objective criteria and techniques for modeling the assessment of risk cutting down dependence on subjective personal judgment. Basel II norms are adopted to prevent banks from unexpected losses, improved profitability, increase risk carrying capacity and undertake more obligations. In consistence with the Basel Accord, it is realistic to expect that additional analytical tools be designed to manage the credit risk more effectively in the periods to come. We can therefore hope that credit scoring models would serve as a platform for these changes. Even though statistical models were formulated about 30 years ago, credit lending does not have any bench marks still paucity of default information continues to prove a principal obstacle to researchers

Academic studies seeking to predict corporate bankruptcies have a long history. An early study was based on a univariate analysis approach (Beaver 1966). Multivariate analysis techniques used in subsequent studies include discriminant analysis (Altman 1968), logit and probit regressions (Ohlson 1980, Zmijewski 1984) and hazard analysis (Shumway 2001). The exact variables used in these studies vary and include both accounting-based and market-based variables, but all of these studies have proposed reduced form models which are able to predict corporate bankruptcies with a fair degree of accuracy. Shumway (2001) compares the forecasting accuracy of a hazard model using a set of five variables, comprising two accounting-based and three market-based variables, to Altman's (1968) and Zmijewski's (1984) specifications which used mainly accounting-based variables, and concludes that the hazard model with accounting and market-based variables is the most accurate. In an examination of secular changes in the ability of accounting variables to predict bankruptcy, Beaver et al. (2005) find a slight decline in the predictive ability of financial ratios based on accounting variables over the period 1962 to 2002, with a corresponding improvement in the incremental predictive ability of market-based variables. Structural models of default, based on Merton (1974) and commercialized by firms like Moody's KMV (Crosbie and Bohn 2001), have also been studied (e.g., Vassalou and Xing 2004; Hillegeist et al. 2004). Although Hillegeist et al. (2004) find that these structural models outperform purely accounting-based, reduced form models, Campbell et al. (2008) find that information from structural models does not add any additional explanatory power to reduced form models utilizing both accounting and market information. Bharath and Shumway (2008) show that the functional form suggested by the Merton model is useful for predicting defaults, though it does not serve as a sufficient statistic for the probability of default.

Model design and methodology

In this paper, a two step methodology has been adopted. The part A provides the steps formulated for the prediction of financial ratio pillars, followed by part B which enlists the steps followed for the prediction of financial ratios using artificial neural networks.

Part A: Formulation of Ratio Pillars

The basic ratios are formulated from details mentioned in published statements like balance sheet, cash flow statements, yearly details of banks, profit and loss statements obtained from CMIE database, Reserve Bank of India. Data is also taken from the official websites of the banks and financial institutions and the internet. Consequently this research work uses financial data i.e. published time series data for the last 11 years from 2000 to 2009.

Part A

Eight ratio pillars have been constructed for the needful being Investment Valuation Ratio Pillar, Profitability Ratio Pillar, Management Efficiency Ratio Pillar, Profit & Loss Ratio Pillar, Debt Coverage Ratio Pillar, Cash Flow Indicator Ratio Pillar, Leverage Ratio. Ratio Pillar, Overall Performance Ratio Pillar.

Part B

Prediction of Financial Ratios using ANN Model. The steps are Catering to Neural Network

inputs, Tolerance level Minimization, Data convergence using Neural Networks, Formulation of Absolute error, Prediction of ratios in each Ratios pillar, Data Validation

BPNN Model application for AXIS Bank

Axis Bank, formerly UTI Bank, is India's third largest private-sector bank after the significantly larger ICICI Bank and HDFC Bank. It is engaged in Large & Mid Corporate Banking, Retail Banking, SME banking, Agri-business banking, International Banking, treasury etc. It has the largest EDC (Electronic Data Capturing) network, the third largest ATM network and the fourth largest base of debit cards in India. As of 31st December, 2010 it had a very wide network of more than 1281 branches including 169 Service Branches and over 5303 ATMs.

The basic input sheets for all the eight pillars are formulated for AXIS Bank. The process of ratio pillar formulation uses the book formulae for computation of the ratios in each pillar, which will further be used as input parameters for Artificial Neural Network. The details of the ratios and the values are enlisted in the table 1.

BPNN Modeling analysis, results and outcomes

After the computation of the basic ratio pillars, as suggested by Table 1, this section uses the ratios in each pillar as inputs to train the network. The network after training computes the values of the ratios from 2009 upto the year 2015 at different tolerance level. The validation is done by the values obtained for the year 2009 and 2010.The tolerance level that provides the closest values is considered for prediction. Table 2 provides details of the percentage error at the adopted level of tolerance.

Observations

The validation was carried out for all the ratios. By the analysis of standard error the included ratios and excluded ratios were formulated. The ratios that have shown a deviation greater than 25% from the actual field data estimates are ignored. Such ratios are termed as excluded ratios. The excluded ratios have not been considered in the prediction process and have been dropped out from the prediction process. The estimates from 2001 to 2008 were applied to train the backpropagation neural network and subsequently estimate the values for the year 2009 to 2010 the data values were used for validation. Based on these values predictions were drawn using BPNN from 2011 to 2015. The market has witnessed several ups and downs during the period 2005 and 2010 and the modeled BPNN has been able to closely predict the values from 2005 to 2010. The trained BPNN has been able to forecast the values of the internal included ratios of the ratio pillar in approximation to the actual values suggesting that the BPNN has the ability to forecast the financial ratios.

Analysis & findings

As per the above convergence study the table 5 provided the details of the size of ANN used for prediction and the associated level of tolerance.

In the *Investment Valuation Ratio* it has been observed that the Dividend per Share moves in the range from 17% to 66% and the similar swing of 10% to 59% has been predicted by the neural network. The ratio Operating Profit Per Share (Rs) shows a movement of 15% to 41% as suggested by the network also being 1% to 38%. The ratio Net Operating Profit Per Share (Rs) shows a movement of 18% to 67% as suggested by the network also being 0.1% to 44%. The ratio Free Reserves Per Share (Rs) shows a movement of 10% to 28% a similar trend is projected by the network. For Earnings Per Share shows a movement from 7% to 68% is observed and the network shows a similar fashion being approximately 1% to 54 %.For Book Value shows a movement from 11% to 40% is observed and the network shows a similar fashion being approximately 5% to 32 %.In the *Profitability Ratio Pillar* it has been observed that the Interest Spread ratio shows a range of 4% to 15%, similar kind of error in the range of 2% to 12% is predicted by the network. The Adjusted Cash Margin (%), moves in the range from 0.2% to 12% and the similar swing of 0.2% to 11% has been predicted by the neural network. The ratio Net Profit Margin shows a movement of 1% to 10% as suggested by the network also being0.2% to 14%. The ratio Gross Profit Ratio shows a movement of 0.2% to 6% a similar trend of 1% to 5% is projected by the network. In the *Profit and Loss Ratio Pillar* it has been observed that the ratio Operating Expense / Total Income shows a movement of 0.5% to 12% as

Table1: Ratios used as Inputs for the Neural Network

Ratio Pillars	Ratios Specifications	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Investment Valuation	Dividend Per Share	0.29	0.89	1.05	1.56	2.20	2.80	3.50	4.50	6.00	10.00	8.17
	Operating Profit Per Share (Rs)	5.35	12.37	17.56	18.25	20.89	22.49	34.12	42.36	56.88	83.56	71.01
	Net Operating Profit/Share (Rs)	42.50	42.50	48.50	49.50	50.23	83.98	128.98	193.93	244.63	377.46	307.18
	Free Reserves Per Share (Rs)	15.00	15.06	15.56	20.05	25.50	54.08	75.38	86.60	208.03	230.47	202.57
	Earnings Per Share	6.53	6.99	8.40	11.72	11.8	17.41	23.40	29.94	50.57	62.06	54.66
	Book Value	22.85	32.0	39.8	49.07	87.9	103.0	120.8	245.1	284.5	395.9	350.8
	Net Operating Income per share	3.47	1.55	7.61	9.40	15.83	0.85	14.80	16.60	26.04	0.05	15.85
Profit	Interest Spread	3.05	3.14	3.24	3.33	3.42	4.09	3.14	3.27	3.77	4.24	4.50
	Adjusted Cash Margin (%)	20.4	19.7	18.9	18.24	17.5	17.47	16.07	14.11	14.19	14.76	13.13
	Net Profit Margin	15.3	15.0	14.7	14.38	14.0	14.33	13.47	12.01	12.22	13.31	12.08
	Return on Long Term Fund (%)	64.13	67.75	71.37	74.99	78.61	70.55	88.56	119.74	71.17	97.35	100.34
	Return on Net Worth (%)	22.0	21.3	20.6	19.93	19.2	18.19	18.28	19.37	12.21	17.77	15.09
	Adjusted Return on Net Worth (%)	13.54	13.54	13.54	13.54	13.54	13.54	16.94	19.45	12.38	17.85	17.54
	Gross Profit Ratio	100	101	98.5	90.76	88.1	87.99	87.48	86.60	91.69	90.09	84.60
Profit & Loss	Interest Expended / Interest Earned	58.02	58.86	59.69	60.53	61.37	62.00	62.68	65.64	63.09	65.98	66.39
	Other Income / Total Income	1.81	1.63	1.45	1.27	1.10	1.48	0.18	0.39	0.16	0.60	0.03
	Operating Expense / Total Income	16.06	17.15	18.25	19.34	20.43	21.02	23.13	23.26	26.20	24.95	26.99
	Selling Distribution Cost Composition	0.48	0.49	0.50	0.51	0.51	0.49	0.47	0.54	0.85	0.34	0.56
	Current Ratio	0.09	0.08	0.07	0.07	0.06	0.06	0.04	0.03	0.03	0.03	0.02
	Quick Ratio	9.79	9.65	9.52	9.38	9.25	11.55	6.52	7.39	9.23	9.52	8.44
Leverage	Financial Leverage	6.93	5.80	4.94	5.25	3.96	3.70	3.64	3.25	3.25	4.08	2.58
	Net financial leverage	0.84	1.01	1.16	1.25	1.66	2.66	3.37	4.08	3.23	13.73	8.42
	Operating Leverage	0.02	0.03	0.03	0.08	0.02	0.03	0.12	0.17	0.05	0.00	0.07
	Interest Coverage	22.5	21.8	22.7	25.53	21.6	13.99	9.28	7.66	6.45	8.57	3.84
	Long Term Debt / Equity	20.4	27.3	37.2	45.89	71.7	139.1	208.2	280.6	286.0	1253	726.3
	Debt-Equity ratio	19.4	25.7	33.6	40.82	63.6	121.5	177.1	242.3	250.9	1519	802.2
	Owner's fund as % of Total Source	0.03	0.05	0.06	0.07	0.12	0.14	0.32	0.33	0.33	1.00	0.67
	Total debt to assets ratio	0.95	0.94	0.90	0.89	0.89	0.87	0.85	0.86	0.88	1.00	0.89
	Long term debt to assets ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.83	0.93

Debt Coverage	Credit Deposit Ratio	19.6	25.3	30.9	36.52	42.1	47.40	52.79	59.85	65.94	68.89	75.81
	Investment Deposit Ratio	54.1	52.7	51.3	49.90	48.4	41.90	49.85	48.96	41.39	39.04	39.97
	Cash Deposit Ratio	16.8	15.7	14.6	13.53	12.4	13.72	8.18	7.17	8.17	8.16	5.74
	Total Debt to Owners Fund	18.32	17.58	16.85	16.12	15.38	13.17	13.97	17.28	9.99	11.49	10.98
	Financial Charges Coverage Ratio	1.69	1.66	1.63	1.60	1.57	1.55	1.53	1.41	1.46	1.43	1.38
	Financial Charges Coverage Ratio Post Tax	1.42	1.41	1.39	1.37	1.35	1.35	1.32	1.26	1.28	1.28	1.24
Cash Flow	Dividend Payout Ratio Net Profit	27.81	27.23	26.64	26.06	25.48	26.22	23.20	22.57	23.49	23.16	21.98
	Dividend Payout Ratio Cash Profit	19.72	19.80	19.87	19.95	20.03	21.08	19.49	19.30	20.47	20.98	20.50
	Earning Retention Ratio	70.9	71.6	72.4	73.20	73.9	73.10	76.88	77.53	76.84	76.94	78.55
	Cash Earning Retention Ratio	79.42	79.46	79.51	79.56	79.60	78.48	80.57	80.78	79.78	79.11	79.89
	Adjusted Cash Flow Times	96.7	93.0	89.2	85.45	81.6	77.77	69.28	75.97	70.42	58.33	59.03
Managerial	Interest Income / Total Funds	3.64	4.40	5.15	5.91	6.66	7.43	8.22	8.88	9.57	10.53	11.19
Efficiency	Interest Expended / Total Funds	1.77	2.18	2.60	3.01	3.42	3.85	4.14	4.87	4.83	5.56	5.88
	Operating Expense / Total Funds	0.25	0.52	0.79	1.06	1.33	1.59	1.90	2.07	2.51	2.64	2.96
	Profit Before Provisions / Total Funds	1.35	1.44	1.53	1.62	1.71	1.84	1.98	1.79	2.07	2.25	2.26
	Net Profit / Total Funds	0.62	0.69	0.77	0.85	0.93	1.05	1.11	1.07	1.17	1.41	1.40
	Loans Turnover	0.18	0.18	0.18	0.18	0.18	0.18	0.19	0.18	0.18	0.19	0.19
	Total Income / Capital Employed (%)	3.74	4.49	5.24	5.98	6.73	7.54	8.23	8.92	9.59	10.60	11.22
	Interest Expended / Capital Employed (%)	1.77	2.18	2.60	3.01	3.42	3.85	4.14	4.87	4.83	5.56	5.88
	Asset Turnover Ratio	0.18	0.22	0.33	0.47	1.66	3.01	4.00	4.97	6.32	7.78	8.77
Overall	Capital Adequacy Ratio	9.25	9.72	10.1	10.66	11.1	12.66	11.08	11.57	13.73	13.69	13.96
	Advances / Loans Funds (%)	30.69	35.85	41.01	46.17	51.34	56.76	58.50	69.07	75.89	73.87	82.30
	Return on invested capital (ROIC)	5.04	2.47	1.75	1.23	1.05	0.72	0.53	0.32	0.23	0.17	-0.96
	Return on Equity (ROE)	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.04	0.04	0.04
	Fixed Assets Ratio	0.41	0.44	0.54	0.78	0.96	1.23	1.51	1.93	1.85	2.15	2.34
	Capital Turnover Ratio	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02
	Sales /net fixed Assets	4.11	5.09	5.19	3.91	3.83	4.46	5.74	6.90	9.30	0.31	5.22

Table 2: The percentage error and Tolerance Level for the Eight Ratio Pillars

Ratio Pillar	Tolerance	Ratios	2009			2010		
			Actual	*Predicted*	*%Error*	*Actual*	*Predicted*	*%Error*
Investment Valuation	0.1	Dividend Per Share	10.000	9.551	24.493	8.173	8.447	-3.348
		Operating Profit Per Share (Rs)	83.560	79.109	5.327	71.005	75.042	-5.685
		Net Operating Profit Per Share (Rs)	377.460	356.298	5.606	307.184	322.867	-5.106
		Free Reserves Per Share (Rs)	230.470	228.672	0.780	202.566	212.321	-4.816
		Earnings Per Share	62.060	60.020	3.288	54.657	58.630	-7.269
		Book Value	395.990	383.897	3.054	350.860	365.991	-4.313
		Net Operating Income per share	0.045	26.033	-57148.2	15.848	26.042	-64.321
Profit & Loss	0.1	Interest Expended / Interest Earned	65.980	64.831	1.741	66.389	64.970	2.137
		Other Income / Total Income	0.600	0.023	96.184	0.028	0.013	53.872
		Operating Expense / Total Income	24.950	25.424	-1.899	26.991	26.686	1.130
		Selling Distribution Cost Composition	0.340	0.848	-149.47	0.562	0.850	-51.214
		Current Ratio	0.030	0.037	-24.647	0.017	0.020	-19.344
		Quick Ratio	9.520	10.217	-7.318	8.437	9.947	-17.899
Profitability	0.1	Interest Spread	4.240	4.063	4.171	4.500	4.263	5.266
		Adjusted Cash Margin (%)	14.760	13.519	8.406	13.130	13.206	-0.577
		Net Profit Margin	13.310	11.807	11.292	12.081	11.680	3.316
		Return on Long Term Fund (%)	97.350	59.804	38.568	100.337	32.836	67.274
		Return on Net Worth (%)	17.770	5.916	66.710	15.091	2.051	86.409
		Adjusted Return on Net Worth (%)	17.850	9.095	49.049	17.535	4.003	77.172
		Gross Profit Ratio	90.092	86.593	3.883	84.595	83.820	0.916
Leverage	0.1	Interest Income / Total Funds	4.082	13.733	0.003	8.569	1253.444	1519.078
		Interest Expended / Total Funds	3.802	2.905	0.006	7.399	326.833	302.919
		Operating Expense / Total Funds	6.857	78.850	-73.359	13.651	73.925	80.059
		Profit Before Provisions / Total Funds	2.580	8.417	0.072	3.837	726.348	802.243
		Net Profit / Total Funds	3.579	2.695	0.001	7.855	348.838	331.519
		Loans Turnover	-24.715	67.980	98.788	-104.723	51.974	58.676
		Total Income / Capital Employed (%)	4.082	13.733	0.003	8.569	1253.444	1519.078
		Interest Expended / Capital Employed (%)	3.802	2.905	0.006	7.399	326.833	302.919
		Asset Turnover Ratio	6.857	78.850	-73.359	13.651	73.925	80.059

Debt Coverage	0.1	Credit Deposit Ratio	68.890	64.200	6.807	75.813	66.151	12.744
		Investment Deposit Ratio	39.040	40.714	-4.289	39.974	40.195	-0.552
		Cash Deposit Ratio	8.160	7.623	6.580	5.741	5.750	-0.157
		Total Debt to Owners Fund	11.490	12.781	-11.232	10.978	11.294	-2.879
		Financial Charges Coverage Ratio	1.430	1.501	-4.988	1.383	1.490	-7.761
		Financial Charges Coverage Ratio Post Tax	1.280	1.321	-3.228	1.244	1.317	-5.850
Cash-flow	0.1	Dividend Payout Ratio Net Profit	23.630	18.695	20.884	23.500	18.947	19.376
		Dividend Payout Ratio Cash Profit	21.700	17.115	21.129	21.840	17.466	20.028
		Earning Retention Ratio	76.380	87.391	-14.416	76.490	87.100	-13.871
		Cash Earning Retention Ratio	78.300	88.829	-13.447	78.150	88.591	-13.360
		Adjusted Cash Flow Times	99.780	80.216	19.607	98.530	84.662	14.075
Managerial Efficiency	0.1	Interest Income / Total Funds	10.530	9.921	5.786	11.191	10.501	6.170
		Interest Expended / Total Funds	5.560	5.832	-4.892	5.883	5.994	-1.881
		Operating Expense / Total Funds	2.640	2.535	3.981	2.955	2.947	0.284
		Profit Before Provisions / Total Funds	2.250	2.395	-6.426	2.259	2.200	2.621
		Net Profit / Total Funds	1.410	1.351	4.149	1.396	1.368	1.977
		Loans Turnover	0.190	0.182	4.348	0.187	0.182	2.715
		Total Income / Capital Employed (%)	10.600	10.233	3.462	11.220	11.522	-2.690
		Interest Expended / Capital Employed (%)	5.560	5.268	5.248	5.883	5.981	-1.665
		Asset Turnover Ratio	7.780	7.500	3.599	8.774	8.301	5.393
Overall	0.1	Capital Adequacy Ratio	13.690	73.870	0.165	0.043	2.146	0.018
		Advances / Loans Funds (%)	12.974	69.754	0.168	0.024	1.305	0.010
		Return on invested capital (ROIC)	5.233	5.572	-1.696	45.291	39.189	46.507
		Return on Equity (ROE)	13.959	82.301	-0.955	0.044	2.341	0.018
		Fixed Assets Ratio	13.412	79.700	0.159	0.024	1.347	0.010
		Capital Turnover Ratio	18.249	29.892	116.641	44.147	42.463	44.954
		Sales /net fixed Assets	13.690	73.870	0.165	0.043	2.146	0.018

Table 3: Details in brief of the predicted ratios in all eight pillars

Ratio Pillar	Tolerance	Ratios	2009	2010	2011	2012	2013	2014	2015
Investment	0.1	Dividend Per Share	4.56	5.98	9.55	8.45	8.79	8.93	9.00
Valuation		Operating Profit Per Share (Rs)	43.08	57.05	79.11	75.04	77.24	78.20	78.72
		Earnings Per Share	31.94	49.29	60.02	58.63	56.84	55.88	56.89
		Book Value	220.94	293.64	383.90	365.99	374.00	377.40	379.18
Profit & Loss	0.1	*Operating Expense / Total Income*	25.42	26.69	26.76	26.79	26.81	26.82	26.82
		Current Ratio	0.04	0.02	0.03	0.03	0.05	0.05	0.05
		Quick Ratio	10.22	9.95	8.51	8.52	8.52	8.52	9.53
Profitability	0.1	*Interest Spread*	4.06	4.26	4.36	4.41	4.43	4.45	4.45
		Adjusted Cash Margin (%)	13.52	13.21	12.98	12.83	12.74	12.68	12.65
		Net Profit Margin	11.81	11.68	11.60	11.55	11.52	11.50	11.49
		Gross Profit Ratio	86.59	83.82	81.27	79.20	77.66	76.55	75.77
Leverage	0.1	Financial Leverage	3.80	3.58	2.55	2.33	2.16	2.03	1.93
		Interest Coverage	7.40	7.85	7.58	7.43	7.34	6.93	6.23
		Total debt to assets ratio	0.97	1.09	0.92	0.92	0.92	0.92	0.92
		Long term debt to assets ratio	0.86	0.80	0.80	0.83	0.88	0.88	0.79
Debt Coverage	0.1	*Credit Deposit Ratio*	64.20	66.15	67.62	68.73	69.57	70.23	70.74
		Investment Deposit Ratio	40.71	40.19	44.71	44.28	43.88	43.52	43.20
		Cash Deposit Ratio	7.62	5.75	5.03	4.46	3.99	3.62	3.31
		Total Debt to Owners Fund	12.78	11.29	11.85	11.45	11.09	10.78	10.50
		Financial Charges Coverage Ratio	1.50	1.49	1.48	1.47	1.46	1.45	1.45
		Financial Charges Coverage Ratio Post Tax	1.32	1.32	1.31	1.31	1.31	1.30	1.30
Cash-flow	0.1	*Dividend Payout Ratio Net Profit*	23.01	21.89	22.89	23.89	22.89	23.89	24.89
		Dividend Payout Ratio Cash Profit	21.01	20.30	21.01	20.01	19.01	20.02	19.02
		Adjusted Cash Flow Times	60.79	60.80	58.80	55.81	50.81	48.82	55.82
Managerial	0.1	*Interest Income / Total Funds*	9.92	10.50	10.74	10.93	10.08	10.20	10.30

Efficiency		*Interest Expended / Total Funds*	5.83	5.99	5.71	5.23	5.31	5.37	5.43
		Operating Expense / Total Funds	2.53	2.95	2.96	2.73	2.68	2.72	2.75
		Profit Before Provisions / Total Funds	2.39	2.20	2.09	2.00	2.02	2.03	2.04
		Net Profit / Total Funds	1.35	1.37	1.26	1.23	1.25	1.26	1.27
		Total Income / Capital Employed (%)	10.23	11.52	10.76	10.94	10.93	11.21	11.31
		Interest Expended / Capital Employed (%)	5.27	5.98	6.01	6.21	6.30	6.36	6.42
		Asset Turnover Ratio	7.50	8.30	8.43	8.78	8.06	8.29	8.47
Overall	0.1	*Capital Adequacy Ratio*	12.97	13.41	13.46	12.50	11.55	11.59	11.63
		Advances / Loans Funds (%)	69.75	79.70	78.60	75.45	70.25	71.01	71.71

suggested by the network also being 0.2% to 5.8%. For Current Ratio a movement from 1% to 83% is observed and the network shows a similar fashion being approximately 0.6% to 75%.For Quick Ratio shows a movement from 3% to 43% is observed and the network shows a similar fashion being approximately 2% to 39%.In the *Leverage Ratio Pillar* it has been observed that the Financial Leverage moves in the range from 1% to 20% and the same movement of ratios has been predicted by the neural network. For the Interest Coverage the ratios oscillate in the range from 2% to 17% and the network suggests a similar trend being 0.01% go 13%. For Total debt to assets ratio shows a movement from 1% to 13% is observed and the network moved a similar pattern. For the Long term debt to assets ratio shows a movement from 0.1% to 17% is observed and the network moved a similar pattern.In the *Debt Coverage Ratio Pillar* it has been observed that the ratio Credit Deposit Ratio shows a movement of 4% to 12% as suggested by the network also being 2.7% to 8%. For Investment Deposit Ratio shows a movement from 2.6% to 15.1% is observed and the network shows a similar fashion being approximately 0.7% to 11%. For Cash Deposit Ratio shows a movement from 0.1% to 29% is observed and the network shows a similar fashion being approximately 1% to 24 %. For Total Debt to Owners Fund shows a movement from 4% to 23% is observed and the network shows a similar fashion being approximately 2% to 24 %. For Financial Charges Coverage Ratio shows a movement from 0.1% to 4.5% is observed and the network shows a similar fashion being approximately 0.2% to 3%. For Financial Charges Coverage Ratio Post Tax shows a movement from 0.1% to 4.5% is observed and the network shows a similar fashion being approximately 0.2% to 3%.In the *Cashflow Ratio Pillar* studies revealed that the Dividend Payout Ratio Net Profit moves in the range from 11% to 4% and the same movement of ratios has been predicted by the neural network. For the Dividend Payout Ratio Cash Profit the ratios oscillate in the range from 7% to 5% and the network suggests a similar trend. For Adjusted Cash Flow Times shows a movement from 5% to 10% is observed and the network moved a similar pattern.In the *Managerial Efficiency Ratio Pillar* study suggested that the Interest Income / Total Funds show a range of 6% to 20%, similar kind of error in the range of 1% to 12%

is predicted by the network. The Interest Expended / Total Funds move in the range from 0.8% to 23% and the similar swing of 0.9% to25% has been predicted by the neural network. The ratio Operating Expense / Total Funds shows a movement of 5% to 21% as suggested by the network also being 4% to 19 %. The ratio Profit before Provisions / Total Funds shows a movement of 0.4% to 16% a similar trend of 0.8% to 26% is projected by the network. For Net Profit / Total Funds, shows a movement from 3% to 20% is observed and the network shows a similar fashion being approximately 5% to 15%.The ratio being Total Income / Capital Employed (%) shows a movement from 5% to 20% is observed and the network shows a similar fashion being approximately 5% to 15%. The Interest Expended / Capital Employed (%), shows a movement from 0.8% to 17% is observed and the network shows a similar fashion being approximately 0.8% to 14%. The Asset Turnover Ratio shows a movement from 12% to 53% is observed and the network shows a similar fashion being approximately 11% to 57%.*In the Overall Ratio Pillar analysis* study revealed that the Capital Adequacy Ratio show a range of 1.6% to 12%, a similar kind of error in the range of 0.3% to 8% is predicted by the network. The Advances / Loans Funds (%) moves in the range from 2% to 16% and the similar swing of 0.9% to 18% has been predicted by the neural network.

The simulation study output suggests that if these parameters are incorporated in the policy decisions the viability of credit lending would in turn be enhanced as the chances of estimating the financial position of the firm at the time of lending and even at the time of changing the policy measures of credit be analysed.

CONCLUSION

In times of economic distress the BPNN model would provide assistance to finding the financial viability of the firm. The tailored back-propagation neural network endeavors to predict the financial ratios expressing the position of a firm to regulate the bankruptcy and assess the credit viability when a bank requires credit and can also be utilized to plan the periods of recovery of the lent amount. We have proposed novel inputs being ratio pillars incorporating certain ratios. As can be seen from the results, the new indicators (included ratios) influence the credit lending and act as the central factors for prediction of credit. This can be explained by the tendency of the financial to be highly volatile, not only of the health of a firm, but also of the health of the economy, which in turn affects the creditworthiness of the firm. The analysis also suggests that the model can forecast the financial position of the firm in case of loan value enhancement as well as the extension of the repayment period implying to be effective in the designing of policy measures related to credit viability thus proves to be a vital tool to regulate the occurrence of credit defaults. As the ratio pillars incorporate all the terms to be included while assessment of the firm's financial position there are less chances of being misguided in the terms of credit lending hence the model can also act as an early warning system for the corporate and can be useful as a communication tool between the credit analyst and the management and hence serve in a practical credit risk policy context.

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