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Dimensionality of the CAMELS Model - A Case Study of Indian Banks

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Abstract

The CAMELS model is one of the most extensively used approaches in bank performance assessment (Sahajwala & Van der Bergh, 2000). It is based on 6 'dimensions': capital adequacy, asset quality, management soundness, earnings potential, liquidity, and sensitivity to market risk. However, the dimensionality of the CAMELS model has never been empirically examined in literature. The present study analyses the dimensionality of the CAMELS model using exploratory factor analysis. The study was performed using a sample of 19 public sector banks and 17 private sector banks operating in India, over the study period 2007-2011, a period of financial crisis and turbulence, prior to the adoption of the Basel III norms. The results of the study suggest that the CAMELS framework should be reorganised, with the same underlying variables, grouped through factor analysis, and prioritised by variance explained. The model provides an explicit measurement of risk as a separate dimension of bank performance. The results of the study also suggest that liquidity, earnings performance, and risk are closely related to one another, with significant negative impact on each other.

Keywords: CAMELS Model, Dimensionality, Exploratory Factor Analysis

Introduction

The importance of bank performance assessment has increased in recent years due to the greater incidence of bank failures in the aftermath of the global financial crisis and the Euro-zone crises. Even banks that were considered 'too big to fail' (such as Lehmann Brothers and Washington Mutual Bank) collapsed, while many others reached the brink of failure.

There are several frameworks used for bank performance evaluation. The CAMELS model is one of the most extensively used approaches in bank performance assessment (Sahajwala & Van der Bergh, 2000). It considers 6 aspects of bank performance, viz., capital adequacy, asset quality, management soundness, earnings and profitability, liquidity, and sensitivity to market risk, paralleling the principles suggested by the Basel Committee for Banking Supervision. In the Indian context, the Reserve Bank of India uses a version of CAMELS for off-site monitoring of banks, with 'S' representing systems. A simpler system, the CAEL model, considers only four aspects of bank performance, viz., capital, assets, earnings, and liquidity. Another framework is the ORAP system, which considers prudential ratios (related to capital adequacy), on- and off-balance sheet activity (related to asset quality), market risk, earnings, and some qualitative criteria (related to internal control). Another evaluation framework is the PATROL system, which considers five aspects: capital adequacy, profitability, credit quality, organisation, and liquidity (Sahajwala & Van der Bergh, 2000).

The present study focuses on the dimensionality of the CAMELS system. The question arises whether the CAMELS parameters are independent or not, or, for example, whether the CAEL framework can capture the same information as CAMELS. Specifically, management soundness, and earnings and profitability may be closely correlated, resulting in an over-emphasis in CAMELS on profitability. Thus, the study analyses possible multicollinearity among the CAMELS parameters, with a

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view to identifying the underlying factor structure in the CAMELS model.

Literature Review

There is extensive literature addressing banking performance evaluation. The use of financial ratios in performance evaluation was initiated by the pioneering studies of Beaver (1966, 1968) and Altman (1968), who used financial ratios for firm bankruptcy prediction.

The CAMELS framework is an extensively used approach for bank performance assessment (Sahajwala & Van der Bergh, 2000). Barr et al. (2002) compared banks' CAMEL ratings with their efficiency scores obtained through DEA and found that they were consistent. Dash and Das (2013) used the CAMELS framework to compare the performance of public sector banks with private/foreign banks in India and found that private/foreign banks performed better than public sector banks, particularly in terms of management soundness, and earnings and profitability. Several studies have also used factor analysis for rating life insurance service providers (Hsiao, 2006, 2008; Yakob et al., 2012).

Njoku (2011) analysed the factor structure of CAMEL, using factor weights to develop an anatomic model of bank performance with 7 structural parameters: market presence, macro-economic condition, deposit mobilisation, prudence, earnings quality, market power, and capital confidence. Njoku and Inanga (2012) used this anatomic model to explain the 2008-2009 global banking crises. Klomp and de Haan (2011) used dynamic factor analysis with the CAMELS framework to develop measures for bank risk. Popovska (2014) used factor analysis to the 6 CAMELS dimensions to construct a measure for bank stability. Maliszewski (2009) and Bhattacharyay (2011) proposed a similar measure.

Thus, several studies have used factor analysis to develop composite measures of bank performance and risk, particularly in the context of the CAMELS model.

Data and Methodology

The objective of the study is to analyse the dimensionality of the CAMELS model. The study also examines the inter-relationship between the factors obtained from the CAMELS model, and compares the performance of Indian public sector banks and private sector banks using them. The variables used in the analysis are the financial ratios corresponding to the CAMELS 'dimensions' (refer Dash & Das, 2013).

Capital adequacy represents the loss-absorbing capacity of a bank, in terms of sufficient capital reserves to cover for unexpected losses. High level of capital adequacy is necessary to maintain depositors' confidence and to prevent the bank from becoming insolvent. In the current study, it is measured using 3 financial ratios: the debt-equity ratio, the coverage ratio, and the capital adequacy ratio.

Asset quality represents the riskiness of the loans/advances the bank has made to generate interest income. Highly-rated companies generally tend to avail lower interest rate terms than lower-rated, doubtful companies, so that asset quality reflects the riskiness of debtors of the bank. In the current study, it is measured using a single financial ratio: net NPA to total advances ratio.

Management soundness represents the efficiency of management in generating revenue (top-line) and in maximising profits (bottom-line). In the current study, it is measured using 4 ratios: total investments to total assets ratio, total advances to total deposits ratio, business per employee, and profit per employee.

Earnings performance represents the current earnings of the bank, and the sustainability and growth in earnings in the future. In the current study, it is measured using three ratios: return on net worth, interest spread to total assets ratio, and profit after tax to total assets.

Liquidity represents the short-term asset position of the bank. In the current study, it is measured using two ratios: government securities to total investment and government securities to total assets.

Sensitivity to market risk represents the ability of the bank to identify, measure, monitor, and manage market risk. In the current study, it is measured by beta, i.e., the systematic risk of the bank's stock returns.

The data for the study pertained to a sample of 19 public sector banks and 17 private sector banks operating in India, listed in Table 1. The study period was 2007-2011. The data for the study consisted of the financial ratios based on the CAMELS framework discussed above. The data source was the Capitaline database[1].

[1] www.capitaline.com

Table 1: List of Sample Banks

Sr. No.	Public Sector Banks	Sr, No.	Private Sector Banks
1	Allahabad Bank	1	Axis Bank
2	Andhra Bank	2	YES Bank
3	Bank of Baroda	3	Standard Chartered
4	Bank of India	4	South Indian Bank
5	Canara Bank	5	Kotak Mahindra
6	Corporation Bank	6	HDFC Bank
7	Central Bank of India	7	Federal Bank
8	Dena Bank	8	Dhanalaxmi Bank
9	Indian Overseas Bank	9	Development Credit Bank
10	Indian Bank	10	Karnataka Bank
11	Oriental Bank of Commerce	11	J & K Bank
12	Punjab National Bank	12	ING Vysya
13	State Bank of India	13	Bank of Rajasthan
14	IDBI	14	SBI Commercial & International Bank
15	Syndicate Bank	15	Citi Bank
16	UCO Bank	16	Tamilnad Mercantile Bank
17	Union Bank of India	17	ICICI Bank
18	United Bank		
19	Vijaya Bank		

Each of the variables was normalised using the formula $z = (x-l)/(u-l)$, where u represents the upper bound (largest value) of the variable, and l the lower bound (smallest value) of the variable. The normalised variables were taken for the factor analysis, and the subsequent factor scores were calculated using the normalised variables, averaged across the 5-year period. Univariate ANCOVA was used to simultaneously test for inter-relationships between the factors.

Analysis and Findings

The descriptive statistics of the CAMELS parameters is presented in Table 2.

Table 2: Descriptive Statistics of CAMELS Parameters

			2007	2008	2009	2010	2011
C	D/E ratio	Mean	17.34	15.60	15.66	16.12	15.62
		Std. Dev.	4.85	5.31	5.06	5.20	4.36
	Coverage ratio	Mean	5.23%	6.31%	6.10%	5.96%	6.16%
		Std. Dev.	1.89%	3.23%	3.20%	3.08%	2.89%
	CAR	Mean	12.19%	13.01%	13.67%	13.76%	13.32%
		Std. Dev.	1.35%	3.16%	2.70%	2.90%	2.09%
A	NNPA/TAdv	Mean	1.00%	0.79%	0.99%	1.02%	0.80%
		Std. Dev.	0.55%	0.54%	0.80%	0.71%	0.48%
M	Tinv/TA	Mean	28.47%	27.49%	28.13%	28.90%	27.65%
		Std. Dev.	3.93%	3.63%	4.26%	4.02%	4.14%
	Tadv/Tdep (CDR)	Mean	72.07%	71.77%	71.60%	72.00%	75.00%
		Std. Dev.	15.46%	10.96%	10.98%	7.39%	8.06%
	BPE (Rs. Crore)	Mean	5.75	6.83	7.95	9.11	10.50
		Std. Dev.	2.62	3.16	3.48	4.07	4.60
	PPE (Rs. Crore)	Mean	0.05	0.06	0.07	0.07	0.09
		Std. Dev.	0.04	0.07	0.08	0.06	0.06
E	RONW	Mean	16.98%	18.04%	17.50%	16.39%	17.03%
		Std. Dev.	6.68%	6.00%	6.27%	9.15%	5.49%
	IntSpr/TA	Mean	0.47%	0.23%	0.54%	0.27%	0.74%
		Std. Dev.	0.36%	0.54%	0.29%	0.41%	0.26%
	PAT/TA	Mean	0.91%	1.03%	0.95%	0.88%	0.98%
		Std. Dev.	0.38%	0.44%	0.57%	0.61%	0.39%

			2007	*2008*	*2009*	*2010*	*2011*
L	Gsec/Tinv	Mean	1.27%	1.11%	0.97%	0.84%	0.77%
		Std. Dev.	0.49%	0.35%	0.23%	0.14%	0.12%
	Gsec/TA	Mean	0.36%	0.30%	0.27%	0.24%	0.21%
		Std. Dev.	0.13%	0.09%	0.06%	0.03%	0.02%
S	Beta	Mean	1.02	0.99	0.99	1.02	1.05
		Std. Dev.	0.45	0.48	0.48	0.45	0.42

There was generally an improvement in capital adequacy during the research period, with lower debt/equity ratio, and higher coverage ratio and CAR. The average CAR was well above the Basel II required level of 9%, and within the Basel III required level of 11%-13.5%[2]. Asset quality was generally stable during the research period, with the net NPA ratio controlled to below 1%, significantly lower than its 2004 levels (about 7%). There was a marked improvement in management soundness, especially in business per employee and profit per employee. However, earnings performance was relatively stable, especially profit after tax to total assets at around 1%, with some improvement in return on net worth and interest spread in 2011. There was a trend decrease in liquidity, with respect to government securities to both total investments and total assets. Sensitivity to market risk was also generally stable, with the average beta approximately equal to 1.

The results of the factor analysis are presented in Table 3.

Table 3: Factor Analysis – Rotated Component Matrix

	Components				
	F1	*F2*	*F3*	*F4*	*F5*
Debt/Equity Ratio				0.686	
Coverage Ratio			0.688		
CAR (%)			0.768		
Net NPA/Total Advances				0.738	
Total Investment/Total Assets	0.876				
Total Advances/Total Deposits (CDR)	0.846				
Business per Employee	0.899				
Profit per Employee	0.888				
Return on Net Worth (%)					0.930
Interest Spread/Total Assets			0.560		
PAT/Total Assets					0.626
Govt. Sec./ Total Investment		0.957			
Govt. Sec./ Total Asset		0.941			
Beta				0.734	
% of Variance Explained	26.03%	16.88%	15.22%	14.61%	13.73%

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalisation.
K.M.O. Measure of Sampling Adequacy: 0.652.
Bartlett's Test of Sphericity: Chi-sq = 544.99, p = 0.000**.
Total Variance Explained: 86.46%.

There were 5 underlying factors, jointly explaining 86.46% of the overall variation in the variables. The K.M.O. measure of sampling adequacy was moderate, and Bartlett's test was statistically significant, indicating multicollinearity of the variables.

The 1st factor (F1) was found to have high factor loadings on total investments to total assets, total advances to total deposits, business per employee, and profit per employee. Thus, this factor represents the management soundness dimension, and explains more than a quarter of the overall variation in the variables.

The 2nd factor (F2) was found to have high factor loadings on government securities to total investments and government securities to total assets. Thus, this factor represents the liquidity dimension.

[2] http://en.wikipedia.org/wiki/Basel_II

The 3rd factor (F3) was found to have high factor loadings on the coverage ratio, the CAR, and the interest spread to total assets ratio. Thus, this factor represents the capital adequacy dimension, and suggests that the interest spread to total assets ratio is closely correlated with capital adequacy of banks.

The 4th factor (F4) was found to have high factor loadings on the debt-equity ratio, the net NPA to total advances ratio, and beta. Thus, these 3 variables were closely correlated, even though they represented different 'dimensions' in the CAMELS framework. In fact, all three variables are measures of different types of risk; the debt-equity ratio is a measure of financial risk, the net NPA ratio is a measure of exposure to credit risk, and beta is a measure of systematic risk. Thus, this factor may be interpreted as the risk factor.

Lastly, the 5th factor (F5) was found to have high factor loadings on return on net worth and PAT to total assets ratio. Thus, this factor represents the earnings performance factor.

The results of the factor analysis suggest that the CAMELS model be replaced by the MLCRE model, as discussed above, prioritised in descending order of percentage of variance explained.

The descriptive statistics of the normalised factor scores are presented in Table 4. The ANCOVA of each of the MLCRE factors are presented in Tables 5a-9b.

Table 4: Descriptive Statistics of Normalised Factor Scores

		2007	*2008*	*2009*	*2010*	*2011*	*Overall*
Management Soundness	Mean	0.2950	0.3038	0.3255	0.3455	0.3650	0.3266
	Std. Dev.	0.0721	0.0719	0.0765	0.0722	0.0841	0.0789
Liquidity Position	Mean	0.5142	0.3954	0.3119	0.2346	0.1729	0.3270
	Std. Dev.	0.3156	0.2204	0.1363	0.0759	0.0541	0.2209
Capital Adequacy	Mean	0.3038	0.3229	0.3616	0.3360	0.3735	0.3394
	Std. Dev.	0.0772	0.1595	0.1465	0.1338	0.0921	0.1275
Risk	Mean	0.4504	0.4037	0.4218	0.4358	0.4165	0.4255
	Std. Dev.	0.1520	0.1649	0.1570	0.1468	0.1440	0.1524
Earnings Performance	Mean	0.6664	0.6903	0.6775	0.6565	0.6745	0.6731
	Std. Dev.	0.1123	0.1031	0.1208	0.1600	0.0926	0.1192

There was a trend increase in management soundness during the research period, and a trend decrease in liquidity position during the research period. Capital adequacy and earnings performance fluctuated during the research period. Risk levels had reached a minimum point in 2008, and subsequently increased slightly.

Table 5a: Tests of Between-Subjects Effects for Management Soundness

Source	*Type III Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Corrected Model	0.290[a]	9	0.032	6.696	0.000
Intercept	0.056	1	0.056	11.602	0.001
type	0.002	1	0.002	0.466	0.496
year	0.049	4	0.012	2.521	0.043
L	0.000	1	0.000	0.078	0.781
C	0.076	1	0.076	15.862	0.000
R	0.001	1	0.001	0.117	0.733
E	0.008	1	0.008	1.716	0.192
Error	0.799	166	0.005		
Total	19.862	176			
Corrected Total	1.089	175			

a. R Squared = 0.266 (Adjusted R Squared = 0.227).

Table 5b: Parameter Estimates for Management Soundness

Parameter	*Coeff.*	*Std. Error*	*t*	*Sig.*
Intercept	0.233	0.053	4.382	0.000
[type=public sector]	−0.014	0.020	−0.682	0.496
[type=private sector]	0[a]	.	.	.
[year=2007]	−0.059	0.023	−2.533	0.012
[year=2008]	−0.054	0.020	−2.705	0.008
[year=2009]	−0.039	0.018	−2.192	0.030
[year=2010]	−0.011	0.017	−0.647	0.518
[year=2011]	0[a]	.	.	.
L	0.012	0.043	0.279	0.781
C	0.225	0.056	3.983	0.000
R	0.016	0.048	0.342	0.733
E	0.069	0.052	1.310	0.192

a. This parameter is set to zero because it is redundant.

Table 6a: Tests of Between-Subjects Effects for Liquidity Position

Source	*Type III Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Corrected Model	5.987[a]	9	0.665	43.265	0.000
Intercept	0.481	1	0.481	31.298	0.000
type	2.615	1	2.615	170.056	0.000
year	2.450	4	0.613	39.840	0.000
M	0.001	1	0.001	0.078	0.781
C	0.016	1	0.016	1.068	0.303
R	0.084	1	0.084	5.458	0.021
E	0.152	1	0.152	9.881	0.002
Error	2.552	166	0.015		
Total	27.357	176			
Corrected Total	8.539	175			

a. R Squared = .701 (Adjusted R Squared = .685).

Table 6b: Parameter Estimates for Liquidity Position

Parameter	*Coeff.*	*Std. Error*	*t*	*Sig.*
Intercept	0.209	0.099	2.110	0.036
[type=public sector]	0.331	0.025	13.041	0.000
[type=private sector]	0[a]	.	.	.
[year=2007]	0.361	0.032	11.464	0.000
[year=2008]	0.243	0.031	7.806	0.000
[year=2009]	0.154	0.030	5.106	0.000
[year=2010]	0.070	0.030	2.339	0.021
[year=2011]	0[a]	.	.	.
M	0.039	0.139	0.279	0.781
C	0.109	0.105	1.034	0.303
R	−0.198	0.085	−2.336	0.021
E	−0.287	0.091	−3.143	0.002

a. This parameter is set to zero because it is redundant.

Table 7a: Tests of Between-Subjects Effects for Capital Adequacy

Source	*Type III Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Corrected Model	1.468[a]	9	0.163	19.647	0.000
Intercept	0.109	1	0.109	13.139	0.000
type	0.154	1	0.154	18.499	0.000
year	0.051	4	0.013	1.541	0.193
M	0.132	1	0.132	15.862	0.000
L	0.009	1	0.009	1.068	0.303
R	0.157	1	0.157	18.857	0.000
E	0.006	1	0.006	0.702	0.403
Error	1.378	166	0.008		
Total	23.121	176			
Corrected Total	2.845	175			

a. R Squared = .516 (Adjusted R Squared = .490)

Table 7b: Parameter Estimates for Capital Adequacy

Parameter	*Coeff.*	*Std. Error*	*t*	*Sig.*
Intercept	0.352	0.069	5.123	0.000
[type=public sector]	−0.108	0.025	−4.301	0.000
[type=private sector]	0[a]	.	.	.
[year=2007]	−0.055	0.031	−1.794	0.075
[year=2008]	−0.048	0.026	−1.798	0.074
[year=2009]	−0.007	0.024	−0.289	0.773
[year=2010]	−0.029	0.022	−1.310	0.192
[year=2011]	0[a]	.	.	.
M	0.388	0.097	3.983	0.000
L	0.059	0.057	1.034	0.303
R	−0.260	0.060	−4.342	0.000
E	0.058	0.069	0.838	0.403

a. This parameter is set to zero because it is redundant.

Table 8a: Tests of Between-Subjects Effects for Risk

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.988[a]	9	0.221	17.674	0.000
Intercept	2.534	1	2.534	202.764	0.000
type	0.320	1	0.320	25.633	0.000
year	0.048	4	0.012	0.969	0.426
M	0.001	1	0.001	0.117	0.733
L	0.068	1	0.068	5.458	0.021
C	0.236	1	0.236	18.857	0.000
E	0.471	1	0.471	37.667	0.000
Error	2.074	166	0.012		
Total	35.934	176			
Corrected Total	4.062	175			

a. R Squared = .489 (Adjusted R Squared = .462).

Table 8b: Parameter Estimates for Risk

Parameter	Coeff.	Std. Error	t	Sig.
Intercept	0.806	0.066	12.282	0.000
[type=public sector]	0.153	0.030	5.063	0.000
[type=private sector]	0[a]	.	.	.
[year=2007]	0.063	0.038	1.672	0.096
[year=2008]	0.018	0.033	0.548	0.585
[year=2009]	0.031	0.029	1.059	0.291
[year=2010]	0.009	0.028	0.338	0.736
[year=2011]	0[a]	.	.	.
M	0.043	0.125	0.342	0.733
L	−0.161	0.069	−2.336	0.021
C	−0.392	0.090	−4.342	0.000
E	−0.469	0.076	−6.137	0.000

a. This parameter is set to zero because it is redundant.

Table 9a: Tests of Between-Subjects Effects for Earnings Performance

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	0.747[a]	9	0.083	7.906	0.000
Intercept	2.053	1	2.053	195.663	0.000
type	0.408	1	0.408	38.863	0.000
year	0.102	4	0.025	2.429	0.050
M	0.018	1	0.018	1.716	0.192
L	0.104	1	0.104	9.881	0.002
C	0.007	1	0.007	0.702	0.403
R	0.395	1	0.395	37.667	0.000
Error	1.742	166	0.010		
Total	82.236	176			
Corrected Total	2.488	175			

a. R Squared = .300 (Adjusted R Squared = .262).

Table 9b: Parameter Estimates for Earnings Performance

Parameter	Coeff.	Std. Error	t	Sig.
Intercept	0.697	0.063	11.062	0.000
[type=public sector]	0.167	0.027	6.234	0.000
[type=private sector]	0[a]	.	.	.
[year=2007]	0.090	0.034	2.645	0.009
[year=2008]	0.072	0.029	2.453	0.015
[year=2009]	0.044	0.027	1.665	0.098
[year=2010]	0.010	0.025	0.396	0.693
[year=2011]	0[a]	.	.	.
M	0.149	0.114	1.310	0.192
L	−0.196	0.062	−3.143	0.002
C	0.073	0.087	0.838	0.403
R	−0.394	0.064	−6.137	0.000

a. This parameter is set to zero because it is redundant.

The results in Tables 5a and 5b show a significant trend increase in management soundness and a significant positive impact of capital adequacy on management soundness; other factors did not have a significant impact on management soundness, and there was no significant difference in management soundness between public sector and private sector banks. The results in Tables 6a and 6b show a significant trend decrease in liquidity position, significantly higher liquidity for public sector than for private sector banks, and a significant negative impact of earnings performance and risk on liquidity position; other factors did not have a significant impact on liquidity. The results in Tables 7a and 7b show significantly higher capital adequacy for private sector than for public sector banks, a significant positive impact of management soundness on capital adequacy, and a significant negative impact of risk on capital adequacy; other factors did not have a significant impact on capital adequacy, and there

was no significant trend in capital adequacy. The results in Tables 8a and 8b show significantly higher risk for public sector than for private sector banks, and a significant positive impact of earnings performance, capital adequacy, and liquidity on risk; other factors did not have a significant impact on risk, and there was no significant trend in risk. The results in Tables 9a and 9b show significantly higher earnings performance for public sector than for private sector banks, a significant trend decrease in earnings performance, and a significant negative impact of risk and liquidity on earnings performance; other factors did not have a significant impact on earnings performance.

Discussion

The results of the study suggest that the CAMELS framework should be reorganised as the MLCRE model, with the same underlying variables grouped through correlation/factor analysis, and prioritised by variance explained. The specific point of difference from the CAMELS model is the grouping together of the D/E ratio, which is usually classified under capital adequacy, the net NPA ratio, representing asset quality, and beta, representing sensitivity to market risk, under a common factor, viz., a risk factor. The MLCRE model thus provides an explicit measurement of risk as a separate dimension of bank performance.

The results of the study also suggest that, in the MLCRE model, liquidity, earnings performance, and risk are closely related to one another, with significant negative impacts on each other. Further, risk is significantly negatively related to capital adequacy, which in turn is significantly positively related to management soundness. This establishes a trade-off, with higher risk levels being associated directly with lower earnings performance, moderated by liquidity position, and indirectly with lower management soundness, mediated by capital adequacy. Paradoxically, improving liquidity directly reduces earnings, but also directly reduces risk, thereby indirectly improving earnings. Thus, liquidity must be used carefully as a control factor, balancing these two counteractive effects. On the other hand, improving capital adequacy directly improves management soundness and reduces risk.

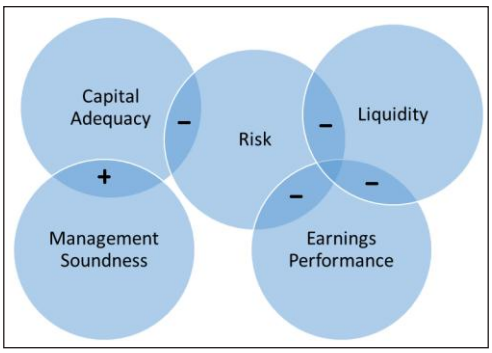

Fig. 1: Significant Association between the Dimensions

Further, there was a significant trend increase in management soundness, and a significant trend decrease in liquidity and earnings performance. In particular, the decline in earnings performance may be due to the impact of the financial crises, and the decline in liquidity may be a result of RBI's easing of liquidity requirements (SLR) in order to stimulate demand during the financial crises. Of course, the improvement in management soundness is an encouraging sign, but needs to be analysed more carefully.

There are several limitations inherent in the current study. The sample size used for the study is relatively small. The study considers a period of only 5 years (2007-2011), which was marked by periodic financial crisis and turbulence, so that the results of the study may be specific to the economic conditions prevailing, and may not be generalisable. Further, the study considers only some performance variables – in particular, variables representing different facets of bank risk, such as interest rate risk; foreign exchange risk should also be included to improve the scope of the model. It is desirable to incorporate qualitative aspects of banking performance into the model.

There is vast scope for further research in the area of bank performance and risk measurement, necessitated by the dynamic nature of the current banking environment. There are several areas, such as efficiency of banks, effective implementation of internal management practices, comprehensive risk measurement, and so on, that must be studied to contribute to a better understanding of performance assessment of banks and risk management

strategies, not only in India but also in other countries. In particular, there are many emerging risks that the present measurement tools are incapable of capturing; these need to be incorporated in the model to reflect the relevant risks and measure them correctly.

References

Altman, I. E. (1968). Financial ratios, discriminant analysis and prediction of corporate bankruptcy. *Journal of Finance, 23*(4), 589-609.

Barr, R., Killgo, K. A., Siems, T. F., & Zimmel, S. (2002). Evaluating the productive efficiency and performance of U.S. commercial banks. *Managerial Finance*, *28*(8), 3-25.

Beaver, W. (1966). Financial ratios as predictors of failure. *Journal of Accounting Research, 5*, 71-111.

Beaver, W. (1968). Market prices, financial ratios and prediction of failure. *Journal of Accounting Research*, *6*(2), 179-192.

Bhattacharyay, B. N. (2011). Macro-prudential monitoring of financial crisis: An empirical framework. In M. Chatterji, D. Gopal & S. Singh (Eds.), *Governance, Development and Conflict (Contributions to Conflict Management, Peace Economics and Development* (vol. 18, pp. 71-121). Emerald Group Publishing Limited.

Dash, M., & Das, A. (2013). Performance appraisal of Indian banks using CAMELS rating. *IUP Journal of Bank Management, 12*(2).

Hsiao, S.-H. (2008). Financial risk management of life insurers by CAMELS rating. *Journal of Global Business Management, 4*(1).

Hsiao, S.-H. (2006). A study of investment performance and overall financial performance for life insurers in Taiwan. Working Paper, Rutgers. Retrieved from http://centerforpbbefr.rutgers.edu/2006/Paper%202006/03AS-077-Shu-Hua%20Hsiao.pdf

Klomp, J., & de Haan, J. (2011). Banking risk and regulation: Does one size fit all? DNB Working Paper No. 323. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=197723

Maliszewski, K. (2009). *Measuring stability of the polish financial system by means of a synthetic index*. Presented at the 12th International Conference on Finance and Banking, held on Oct. 28-29, 2009, Organised by Silesian University in Opava.

Njoku, J. (2011). Anatomic assessment of CAMEL in Nigerian banking. *International Journal of Economics and Accounting, 2*(1), 76-99.

Njoku, J., & Inanga, E. L. (2012). Underlying nature of the 2008-2009 banking crises. *African Journal of Accounting, Auditing and Finance, 1*(2), 190-208.

Popovska, J. (2014). Modelling financial stability: The case of the banking sector in Macedonia. *Journal of Applied Economics and Business*, *2*(1), 68-91.

Sahajwala, R., & van der Bergh, P. (2000). Supervisory risk assessment and early warning systems. Basel Committee on Banking Supervision Working Papers, No. 4, Bank of International Settlements.

Yakob, R., Yusop, Z., Radam, A., & Ismail, N. (2012). CAMEL rating approach to assess the insurance operators financial strength. *Jurnal Ekonomi Malaysia, 46*(2), 3-15.