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## **Modelling the recovery of Indian banks under prompt corrective action framework: TOPSIS methodology**

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**Abstract:** The current study empirically investigates the comparative financial health of each of the 12 Indian banks under prompt corrective action (PCA) framework considering multiple triggers of PCA framework collectively. A model for predicting the recovery of these banks from PCA has been proposed based on three different multi-criteria decision-making methods (MCDM), one being the technique for order of preference by similarity to the ideal solution (TOPSIS) proposed by Hwang and Yoon (1981) to rank the set of alternatives. It has been hypothesised that higher the rank, faster could be the recovery of a bank based on multiple trigger values of these banks for three to four years from the date of revised PCA framework. The results have been amply validated with the action of the Indian banking regulator, the Reserve Bank of India, to declare some of the banks out of PCA framework in January and February 2019.

**Keywords:** prompt corrective action; PCA; Reserve Bank of India; RBI; CRAR; CET1; NNPA; leverage ratio; weighted average deviation index; TOPSIS methodology; modelling PCA banks' recovery.

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## 1 Introduction

### 1.1 *Brief history of banking in India and banking reforms*

The banking system in India has passed through five distinct phases in over five decades since independence: evolutionary phase (prior to 1950), foundation phase (1950–1968), expansion phase (1968–1984), consolidation phase (1984–1990) and reformatory phase (since 1991). A huge growth phase was observed in the banking sector as a result of the nationalisation of commercial banks in 1969 and again in 1980. The aim of nationalisation was the effective decentralisation of credit to priority sectors such as agriculture, small scale industries, small businesses and exports, the hitherto neglected sectors of economy, and to provide banking facilities and liberal credit in rural areas.

According to McKinnon (1973) and Shaw (1973), until the beginning of the 1990s, the state of the financial sector in India could be described as a perfect case of ‘financial repression’. The sector was characterised, *inter alia*, by administered interest rates, large pre-emption of resources by the authorities and extensive micro-regulations directing the major portion of the flow of funds to and from financial intermediaries. There were concerns about the viability of banks, most of them being public sector entities (having a market share of about 75%). The true health of banks was masked by relatively opaque accounting norms and limited disclosures. In 1991, the global credit-rating agencies downgraded India from investment grade, leaving the government with no option but to mortgage the country’s gold to raise just 400 million USD to avoid defaulting on payments. The crisis led to the liberalisation of the Indian economy and financial sector reforms of the 1990s.

Narsimham Committee (I) Recommendations (1991–1992) were implemented as a first phase of banking reforms, e.g., lowering of statutory liquidity ratio (SLR) and cash reserve ratio (CRR), introduction of prudential norms and capital adequacy norms, deregulation of interest rates, competition from new private sector banks, phasing out of directed credit and access of banks to capital market, etc.

During the second phase of reforms (1998), the Narsimham Committee (II) placed greater importance on structural measures and improvement in standards of disclosure and levels of transparency. Major recommendations implemented were: new instruments, risk management, universal banking, managerial autonomy, laws on recovery of debts, strengthening the use of technology in banks, base rate system of interest rates and management of non-performing assets (NPAs). Adoption of global standards through Basel I, II and III norms as tools for management of various risks was mandated for all banks.

The Government of India enacted several laws and established law enforcement agencies to help the banks recover the loans speedily, e.g., Peoples Courts (alternative debt dispute resolution mechanism in India), Debt Recovery Tribunals, the Securitisation and Reconstruction of Financial Assets and Enforcement of Securities Interest Act, 2002 (also known as the SARFAESI Act), One Time Settlement scheme, Corporate Debt Restructuring Scheme, and the Insolvency and Bankruptcy Code, 2016. The borrowers outsmarted the banks by approaching courts for grant of stay and using other dubious ways against recovery efforts of banks. NPAs kept rising.

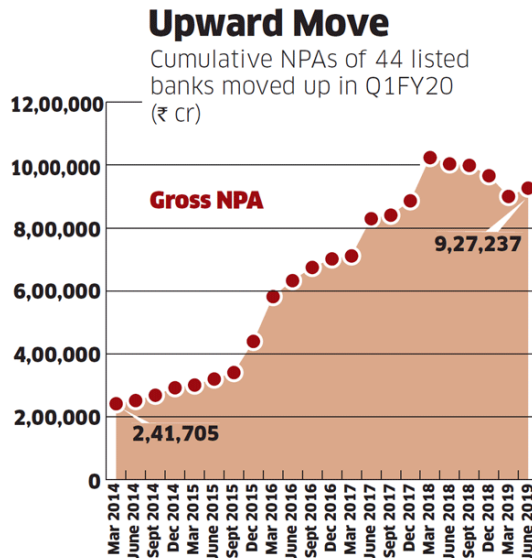
The Reserve Bank of India (RBI), in 2013–2014, detected under-reporting of NPAs by many banks and pressed them to clean up their balance sheets by declaring all NPAs

within three years. The NPAs reached astounding figures from 2015–2016 to 2018–2019 when they peaked. The five primary issues that ail Indian banks today are:

- 1 poor credit appraisal and decision making due to lack of capacity to judge project quality
- 2 a structural asset-liability mismatch for the banks due to longer-dated assets and short-dated liabilities
- 3 undue delay in recognising NPAs on the books
- 4 outright fraud and lack of fundamental corporate governance standards
- 5 cyclical business slowdown or failures.

The banking system is traversing a challenging phase handling issues such as capital, quality of assets, deposits and credit allocation. The process of recognition of NPAs gained in precedence when the asset quality review system was invoked. NPAs have been increasing subsequently as banks progressively recognised their stressed assets. It is believed that this process has been more or less completed for most banks and the NPA levels have stabilised in the last couple of quarters, that is, Q-3 and Q-4 of FY 18–19. We can look at some of these trends across banks, both public sector banks (PSBs) and private banks as per Figure 1.

**Figure 1** Trends of gross NPAs of banks (2014–2019) (see online version for colours)



Source: ETIG/Capitaline

RBI has adopted current Basel III norms for capital adequacy ratio and multiple risks management. There is an extra need to monitor banks on various other parameters as prudence of the regulator to arrest their deteriorating health. The regulator can additionally take prompt corrective action (PCA) before it is too late. RBI had designed the PCA framework in the year 2002 and revisited it in the year 2017.

Twelve (12) banks were considered to be under the PCA framework with effect from 1 April 2017, based on five triggers as of 31 March 2017 for capital adequacy ratio (CRAR), common equity tier-1 (CET1) ratio, net non-performing assets (NNPAs) ratio, return on assets (RoA) and leverage ratio. Any single trigger was considered enough for putting a bank under PCA framework.

### *1.2 Importance of health of the banks for India and the Indian economy*

Productive credit growth brings investments for industry and trade which leads to economic growth. In India, a developing country, hundreds of millions of individuals, and millions of businesses and entrepreneurs operate in the informal economy. They have only limited access to financial services. Many of them could use credit effectively to build a business or an enterprise or buy a motorbike to get to work. Commercial banks help fund the large agricultural sector in India. They provide loans to traders in agricultural commodities. The rural population also needs credit for running agricultural and allied activities for sustenance. They open a number of branches in rural areas to provide agricultural credit to make the financial services inclusive in the predominantly agrarian economy of India. Banks thus play an important role in the creation of new capital and help the economic growth process, much needed by a country like India to reduce poverty across regions.

In view of the foregoing, a healthy and thriving banking system is a sine qua non for sustained trust of depositors and investors in banks for stability and growth of the financial system and economy of a country. Banks are the backbone of any economy and play a vital role in the economic development of the country.

The study has suggested a model to compare and rank the financial position of banks under PCA based on all five triggers collectively in bringing a bank under the PCA framework instead of only one of the triggers. The study has provided a tool to the regulator to decide which bank under PCA should be taken first out of the PCA framework based on its rank generated by the model. The model has later been substantially validated by the actual action of the regulator.

## **2 Theoretical background**

### *2.1 First PCA framework (2002)*

The PCA framework was introduced in December 2002 as a structured, early intervention mechanism along the lines of the Federal Deposit Insurance Corporation's (FDIC) PCA framework. CRAR, NNPAs and RoA were the triggers. Subsequently, the framework was reviewed based on the recommendations of the working group of the Financial Stability and Development Council (FSDC) on Resolution Regimes for Financial Institutions in India and the Financial Sector Legislative Reforms Commission (FSLRC).

### *2.2 Revised PCA framework (2017)*

The framework was revised effective from 1 April 2017, based on the financials of the banks for the year ended 31 March 2017.<sup>1</sup> Total CRAR and CET1 ratio, asset quality and profitability, along with leverage ratio, continued to be the key areas for monitoring. The

PCA framework is not intended to constrain performance of normal operations of banks for the general public. The indicators and triggers of each parameter as per graded risk threshold 1, 2 or 3 are detailed in Appendix 1. The kinds of restrictions that the PCA invokes on banks are given in Appendix 2.

Twelve Indian banks feature in the list. Eleven banks have breached the threshold, between February 2014 and January 2018, as set by the asset quality parameter which specifies penal action on NNPA's of a bank breaching the trigger of 6% of its net advances. On the RoA parameter, all 12 banks have reported negative numbers (negative net worth trigger) in financial year (FY) 2016–2017. RoA of Dhan Laxmi Bank remained negative for the last three consecutive years, that is, FY 14–15, FY 15–16 and FY 16–17, and was classified under risk threshold two. The RoA numbers have assumed greater significance since the government infused capital into public sector banks based on their weighted average of RoA for the previous three financial years, among other things.

### *2.3 Banks under PCA attracted multiple triggers*

It has been observed that most of the banks under PCA fell short on account of more than one trigger. It was proposed to work out a method to consider all triggers together to find out the comparative financial health of each bank under PCA at a given time.

We have proposed a model for predicting the recovery of banks under the PCA framework based on three different multi-criteria decision making methods (MCDM), namely, weighted average index method, weighted average deviation index method and the technique for order of preference by similarity to the ideal solution method (TOPSIS) proposed by Hwang and Yoon (1981) to rank the set of alternatives. The banks were ranked by these three methods. Higher the rank, faster would be the recovery of the bank under the PCA framework based on parameter values of all 12 banks for FY 15–16 to FY 17–18 and the first three quarters of FY 18–19. Then we tried to validate the results with the action of RBI to declare some banks out of PCA framework immediately after the end of Q-3 of FY 18–19.

The study has provided a reliable method of ranking the banks based on their financial health indicated by the values of multiple parameters or triggers of PCA framework instead of any single trigger.

### *2.4 Scope of the study*

The Indian banking system consists majorly of 18 public sector banks, 22 private sector banks, and 46 foreign banks as of September 2019. The scope of our study is limited to modelling the recovery of those banks which are under the PCA framework of RBI. There were only 12 banks under PCA at the time of study and hence only these 12 banks have been analysed.

### *2.5 Scheme of presentation*

The following sections of the paper are based on the theoretical background thus presented in Section 2. Section 3 contains the review of Indian and international literature on the subject. Section 4 discusses the research gap and problem statement. Section 5 presents the methodology, hypotheses and statistical models used. Section 6 presents

analysis, discussions and the findings. Section 7 deals with policy implications of the findings of the study. Section 8 presents the future directions for research.

### 3 Literature review

In the 1980s and early 1990s in USA, more than 1,600 commercial and savings banks insured by the Federal Deposit Insurance Corporation (FDIC) were either closed or given financial assistance. The cumulative losses of the failed institutions exceeded 100 billion USD. In December 1991, the US Congress passed the Federal Deposit Insurance Corporation Improvement Act (FDICIA), which emphasised the importance of capital ratios in addressing the problems. The second key provision of FDICIA was the prompt corrective action (PCA), an early intervention in problem banks by bank regulators in an effort to save those banks from becoming insolvent. As observed by Kane (1981), such an early closure policy had been advocated as a solution to excessive losses to the deposit insurance fund.

Aggarwal and Jacques (1998) concluded in a study that the PCA provisions of FDICIA had improved the safety and soundness of the US banking system. Failures declined substantially. PCA had been successful in getting banks to increase capital. Estrella et al. (2000) observed that the leverage and gross revenue ratios contained valuable and virtually costless information, and therefore had a role in an overall framework for regulatory capital. They compared the effectiveness of different types of capital ratios in predicting bank failure. This finding suggested that bank regulators found a useful role for the simple ratios in the design of regulatory capital frameworks, particularly as indicators for the need for prompt supervisory action. Risk weighted ratios, in contrast, tend to perform better over longer horizons.

Michael and Vasanthi (2004) analysed the performance of scheduled commercial banks in India with regard to the three parameters: CRAR, NPA and RoA. They found that the PCA had made banks improve their quality of assets and reduce NPAs.

Freixas and Parigi (2008) explored the rationale for regulations that prohibited banks from developing some of their natural activities when their capital level was low, as embodied in the US prompt corrective action (US-PCA). They showed that the optimal capital regulation consisted of a rule that allowed well capitalised banks to freely invest any amount in any risky asset, and prohibited banks with intermediate levels of capital to invest in most opaque risky assets and prohibited undercapitalised banks to invest in any risky asset.

Jordan et al. (2010) studied whether a formula, which included certain open sourced variables readily available from bank quarterly call reports, had strong predictive power in identifying the failed banks up to four years prior to failure. The results strongly supported the proposition that a formula that included the seven listed variables could predict with 88.2%, 78.6%, 71.4% and 66.0% accuracy whether a bank would fail within one year, two years, three years, or four years, respectively.

Svoronos (2018) at Financial Stability Institute (FSI) of the Bank for International Settlements (BIS), in his working paper, proposed that the prudential authorities conducted early interventions with the aim of prompting banks to address their weaknesses in a timely manner. The first formal early intervention regime was PCA, introduced by the USA in 1991. The most recent was the European Union's Early

Intervention Measures (EIM), introduced in 2014. Similar PCA frameworks existed in Japan, Denmark and several other countries.

Tirado (2017) observed that the most notable feature of PCA was the proportionality of measures and the flexibility enjoyed by a resolution authority that might accommodate its intervention as per the characteristics of the case and the degree of contagion risk. Although mainly inspired by the American model, the system was compared with the new European framework, European Union's Early Intervention Measures (EIM). Financial Stability Board (FSB) recommendations were also considered.

Panda et al. (2018) studied and elaborated how Indian banking was passing through a difficult phase of twin balance sheet problem and depleting capital base. Twin balance sheet problem refers to the stress on balance sheets of banks due to NPAs or bad loans on one hand, and heavily indebted corporates, on the other. Lenders were not so comfortable in referring the stressed assets for insolvency proceeding to the National Company Law Tribunal (NCLT), given the structure of present Insolvency and Bankruptcy Code, 2016 (IBC-2016). As Bad Bank (BB) model had been successful in many advanced economies, the time had come for Indian banks to try this model. Given the dominance of PSBs in Indian banking system, the study suggested an appropriate government-owned BB model to relieve the leveraged banking system.

The 17th Financial Stability Report (RBI, 2018) brought out by RBI reflected the overall assessment of the stability of India's financial system and its resilience to risks emanating from global and domestic factors and developments in and regulation of the financial sector.

## **4 Research gap and problem statement**

### *4.1 The research gap*

The literature survey on the topic of study has revealed that international researchers have studied, in general, about the framework of PCA in USA, Japan and a few other countries like Sweden. Only a very few Indian researchers have studied the PCA framework for Indian banks.

We were unable to find a study which was conducted to evaluate two banks under PCA to judge their comparative financial strength to come out of the PCA framework. Only one trigger is sufficient to put a bank under PCA but it had been observed that most of the banks attracted PCA due to multiple triggers working simultaneously. No study has been conducted yet to predict the possibility of faster recovery of one bank under PCA compared to another bank under PCA considering multiple triggers collectively. This approach to the issue is quite novel.

### *4.2 The problem statement and objective of the study*

- 1 To study the framework of PCA for banks; various triggers for putting the bank under PCA and the measures generally taken to bring the banks to normal health in the Indian context.

- 2 To propose a new and innovative decision making framework for recovery of banks out of PCA by comparing their financial strength among themselves based on all the critical triggers considered collectively.

#### *4.3 Significance of study from the viewpoint of India as well as from global viewpoint*

The banking system offers wealth holders a wide array of financial assets and ample choices of portfolios with attractive combinations of income safety and yield. The portfolio choice also improves the financial progress and leads to innovation in financial technology. Therefore, financial progress induces larger savings out of the same level of income.

Various types of banks such as public sector, private sector and cooperatives are all vital cogs in the wheel of the Indian economy and are all needed for the next phase of economic growth. The distribution reach that such an extensive network of banks provides is the foundation of the credit framework for inclusion.

Banks are biggest intermediaries between savers and investors among all the fund mobilising financial institutions for the growth of the economy. Banks are safest option for savers only second to investment in government bonds where there is no risk of sovereign default. Majority of the savers do not deal in government bonds and depend on banks for safe-keeping of their funds and also for securing reasonable and almost risk free returns. The weakness of any bank resulting in its failure leads to loss of confidence of the public in the entire banking system which may lead to collapse of financial system in India.

According to World Development Report (World Bank 1989), the countries with a well-developed financial system grow faster than countries with a weak financial system. Although, money and finance by themselves cannot bring about development in economy, a well-developed financial system can help the economy to achieve higher rates of growth. Failure of banks in one country may lead to systemic failure of banks in other countries also due to close links of banks within and beyond territorial boundaries due to globalisation of economies. For all these reasons, the study is important and very relevant even in the global context.

## **5 Methodology**

### *5.1 Data collection*

The secondary data has been sourced from various published results and financial statements of the banks covered in the study. The financial statements have been obtained on the banks' websites. Furthermore, data has also been sourced from supplement statement of disclosures of banks, under Basel-III norms.



**Table 1a** Trigger wise comparison of PCA banks as of 31 March 2017

Sr. no.	PCA parameter	2016-2017											Trigger	
		Allahabad Bank	Bank of India	Bank of Maharashtra	CBI	Corporation Bank	Dena Bank	DhanLaxmi bank	IDBI Bank	IOB	OBC	United Bank of India		Uco Bank
1	CRAR	11.61	12.62	11.18	10.95	11.32	11.39	10.26	10.80	10.50	11.64	11.14	10.93	10.25
	C/TETI	8.20	7.71	7.28	8.62	8.9	7.24	9.01	5.75	7.58	7.59	7.74	7.52	6.75
2	NNAPA	8.92	6.89	11.76	10.20	8.33	10.66	2.58	13.21	13.99	8.96	10.02	8.94	6
3	ROA	-0.13	-0.24	-0.86	-0.80	0.23	-0.67	0.10	-1.39	-1.21	-0.46	0.16	-0.75	6
4	Leverage ratio	5.23	4.78	5.01	4.47	5.04	5.46	4.26	4.89	5.02	5.64	4.34	4.11	3.5

**Table 1b** Trigger wise comparison of banks as of 31 March 2018, and Q1, Q2, Q3 of FY 18–19

Sr. no.	PCA parameter	Capital adequacy						Asset quality					
		2015–2016	2016–2017	2017–2018	2018–2019	2018–2019	2018–2019	2018–2019	2018–2019	2018–2019	2018–2019	2018–2019	2018–2019
	Year	2015–2016	2016–2017	2017–2018	2018–2019	2018–2019	2018–2019	2018–2019	2018–2019	2018–2019	2018–2019	2018–2019	2018–2019
	Standard/trigger	<9.625	<10.25	<10.875	<10.875	<10.875	<10.875	>10	>6.00	>6.00	>6.00	>6.00	>6.00
1	Allahabad Bank	11.02	11.61	8.69	7.08	10.59	7.28	6.76	8.92	8.04	7.32	7.96	7.70
2	Bank of India	12.38	12.62	13.54	12.09	10.93	10.93	7.78	6.89	8.23	7.66	7.66	5.87
3	Bank of Maharashtra	11.20	11.18	11.00	10.141	9.871	11.05	6.35	11.76	11.24	12.2	10.61	5.91
4	CBI	10.41	10.95	9.04	8.05	8.71	9.34	7.36	10.20	11.10	10.58	10.36	10.32
5	Corporation Bank	10.56	11.32	9.23	8.46	11.12	11.12	6.53	8.33	11.74	11.46	11.65	11.47
6	Dena Bank	11.0	11.39	11.09	10.60	10.10	10.21	6.35	10.66	11.96	11.04	11.70	10.44
7	DhanLaxmi bank	7.5	10.26	13.87	13.07	14.16	13.52	2.78	2.58	3.19	3.79	2.92	2.932
8	IDBI Bank	11.76	10.80	10.41	8.35	6.41	12.51	6.78	13.21	16.69	18.76	17.3	14.01
9	IOB	9.66	10.50	9.25	7.98	9.16	8.86	11.89	13.99	15.33	15.1	14.34	13.56
10	OBC	11.76	11.64	10.5	10.25	10.35	12.62	6.7	8.96	10.48	10.63	10.08	7.15
11	United Bank of India	10.08	11.14	12.62	10.96	7.82	9.99	9.04	10.02	16.49	15.17	14.36	12.08
12	Uco Bank	9.63	10.93	10.94	9.18	7.57	9.33	9.09	8.94	13.10	12.74	11.97	12.48
	PCA parameter												
		Profitability						Leverage ratio					
Sr. no.	Year	2015–2016	2016–2017	2017–2018	2018–2019	2018–2019	2018–2019	2018–2019	2018–2019	2018–2019	2018–2019	2018–2019	2018–2019
	Standard/trigger	>0.25	>0.00	>0.00	>0.00	>0.00	>0.00	<-3.25	<3.5	<3.51	<3.51	<3.51	<3.51
1	Allahabad Bank	-0.33	-0.13	-1.96	-3.22	-3.05	-1.24	5.35	5.23	3.64	2.57	2.59	3.65
2	Bank of India	-1.00	-0.24	-0.96	0.06	-0.70	-2.85	4.80	4.78	5.00	4.29	4.29	4.62
3	Bank of Maharashtra	0.07	-0.86	-0.73	-2.83	0.07	-9.62	5.27	5.01	4.54	3.83	3.74	4.15
4	CBI	-0.48	-0.80	-1.61	-1.85	-1.11	-0.86	5.17	4.47	3.66	3.66	3.66	3.49
5	Corporation Bank	-0.23	0.23	-1.67	0.17	0.21	0.12	4.56	5.04	4.09	3.62	4.99	5.08
6	Dena Bank	-1.02	-0.67	-1.59	-2.43	-1.44	-0.63	5.26	5.46	5.10	4.51	4.51	4.06
7	DhanLaxmi bank	-1.61	0.10	-0.2	-1.50	-0.55	-0.18	3.13	4.26	4.92	4.76	4.93	5.07
8	IDBI Bank	-1.02	-1.39	-2.46	-2.92	-4.51	-5.19	5.81	4.89	4.33	3.46	2.32	5.04
9	IOB	-0.97	-1.21	-2.33	-1.35	-0.71	-0.50	5.5	5.02	3.86	2.99	3.75	3.42
10	OBC	0	-0.46	-2.31	-0.65	0.16	0.23	5.86	5.64	4.50	4.28	4.21	5.28
11	United Bank of India	-0.22	0.16	-1.04	-1.08	-2.43	-3.17	4.31	4.34	4.26	3.31	2.37	2.93
12	Uco Bank	-1.25	-0.75	-1.88	-1.10	-1.97	-1.76	3.90	4.11	4.18	3.31	2.57	3.38

## 5.2 Application of statistical tools

The individual trigger wise position of PCA banks as on 31 March 2017 is given as per Table 1a. All the five triggers have been depicted in this table.

## 5.3 Observations on each trigger

The comparison of all the five trigger values of banks for FY 16–17, FY 17–18 and the first three quarters of FY 18–19 is given hereunder:

- 1 *Capital to risk weighted assets ratio (CRAR)*: no bank under consideration attracted PCA under this parameter as of 31 March 2017. As of 31 March 2018, the trigger point of CRAR rose to 10.875% under Basel III norms and six banks slipped in maintaining this enhanced level of CRAR. By the end of Q-3 of FY 18–19, four banks were still below even the revised reduced trigger CRAR of 10.50.
- 2 *CET1 trigger*: only one bank, namely, IDBI Bank had lower ratio of 5.75% as of 31 March 2017. As of 31 March 2018, against higher CET1 ratio trigger of 7.375% as per Basel III norms, four PCA banks slipped and failed to meet this ratio.
- 3 *NPA trigger*: as of 31 March 2018, 11 of 12 PCA banks had NNPA ratio of much higher than trigger point of 6% except Dhan Laxmi Bank at 2.58%. But, Dhan Laxmi Bank had a negative RoA for more than two consecutive years and hence, was also put under PCA. Towards the end of Q-3 of FY 18–19, nine banks still had NNPA ratios above 6%.
- 4 *RoA trigger*: as of 31 March 2017 (FY 16–17), nine of 12 banks had negative RoA consecutively for second and third years. As of 31 March 2018, again, all 12 banks reported negative RoA ranging from –0.20% to –2.46%. By the end of Q-3 of FY 18–19, only two banks had improved RoA in positive territory.
- 5 *Leverage ratio trigger*: for FY 16–17 as well as FY 17–18, all PCA banks had a leverage ratio of more than the trigger point 3.5%. But by Q-3 of FY 18–19, four banks slipped from the leverage ratio of 3.5%.

## 5.4 Constructing a weighted average index

It was assumed that the overall financial health of the bank can be better judged by a weighted average index or score of each bank built on all the trigger parameter values collectively. Higher the weighted average index, better the chances of a PCA bank recovering to normal health or coming out of PCA framework. We have attempted to construct a weighted average index for each bank based on all the critical parameter/trigger values collectively as described hereunder:

- a *Capital to risk weighted assets ratio*: higher CRAR is considered a positive factor as a higher CRAR is better for risk mitigation for the bank.
- b *Common equity tier-1 (CET1) ratio*: we have not included CET1 ratio as it is very much a part of CRAR which is a more inclusive indicator for risk for a bank. Moreover, if we include CET1 value in index, the capital ratio will have unduly excessive weight in the index.

- c *NNPA-ratio*: higher the NNPA ratio, higher is the risk. Hence, we have considered this figure as a negative value in the composite index.
- d *Return on assets (RoA)*: RoA is a measure of profitability of the bank. Hence, we have considered this figure as positive for the composite index.
- e *Leverage ratio*: higher the leverage ratio, the better it is to reduce the risk on the whole for the bank. Hence, this figure has been considered as positive for the composite index.

Thus, the composition of weighted average index has been worked out by adding the four weighted trigger parameter values of CRAR, RoA and leverage ratio (positives) and subtracting NNPA ratio (negative) from the sum of above three parameter values for each bank. The trigger wise values of banks for FY 17–18 and first three quarters of FY 18–19 are provided in Table 1b. Four triggers: CRAR, asset quality, profitability and leverage have been depicted in this table.

### 5.5 *Construction of weights*

The deterioration in trigger parameters has not taken place in a single year. The financial position of banks has been changing for some years before as well as after the effective date of PCA framework (modified on 31 March 2017). To make the index a still better indicator for comparative financial health of the PCA banks, we have worked out the average composite index for last three years and three quarters. During this period, mostly an increasing amount of NPAs have been declared by banks to clean up their balance sheets on strong persuasion by RBI. We have given higher weight (20%) to the most recent results and lower weight (15%) to the results for previous years, as provided below:

- FY 15–16: 15%
- FY 16–17: 15%
- FY 17–18: 15%
- FY 18–19 (first quarter): 15%
- FY 18–19 (second quarter): 20%
- FY 18–19 (third quarter): 20%.

On comparison of the weighted average index, the comparative strength/weakness of each PCA bank compared with other banks has been ranked, as depicted in Table 2.

### 5.6 *Constructing an average weighted deviation index*

A still better indicator of financial health of banks could be the measure of deviation from the trigger values of each year for the banks under PCA. Each year, the triggers for CRAR change as per Basel III requirements. Positive incremental values beyond the trigger point like CRAR, RoA, and leverage ratio have been added and negative incremental value above the trigger points like NNPA ratio, have been deducted. We have given higher weight to the most recent results and lower weight to past results as done for the weighted average index. The result of ranking is provided in Table 3.

**Table 2** Comparative strength of banks based on weighted average index

<i>Sr. no.</i>	<i>Bank</i>	<i>Weighted average index sum of (parameter values * Wt)</i>	<i>Rank</i>
1	Allahabad Bank	8.66	6
2	Bank of India	13.70	2
3	Bank of Maharashtra	7.99	7
4	CBI	7.14	8
5	Corporation Bank	9.49	4
6	Dena Bank	8.68	5
7	Dhan Laxmi Bank	18.15	1
8	IDBI Bank	1.57	12
9	IOB	3.10	11
10	OBC	11.77	3
11	United Bank of India	4.43	10
12	UCO Bank	5.03	9

**Table 3** Comparative strength of banks based on weighted average deviation index

<i>Sr. no.</i>	<i>Bank</i>	<i>Wtd. average deviation index Sum of (deviation from trigger values * Wt)</i>	<i>Rank</i>
1	Allahabad Bank	16.17	6
2	Bank of India	21.210	2
3	Bank of Maharashtra	15.50	7
4	CBI	14.65	8
5	Corporation Bank	16.99	4
6	Dena Bank	16.19	5
7	Dhan Laxmi Bank	25.66	1
8	IDBI Bank	9.08	12
9	IOB	10.61	11
10	OBC	19.28	3
11	United Bank of India	11.938	10
12	UCO Bank	12.54	9

### 5.7 TOPSIS methodology

In order to analyse the comparative performance of the banks under consideration, the TOPSIS method has been used. TOPSIS stands for technique for order of preference by similarity to the ideal solution. It is a multi-criterion, decision making method proposed by Hwang and Yoon (1981) to rank the set of alternatives. The steps involved in TOPSIS are described below:

Step 1 Performance data is obtained for  $j$  alternatives over  $i$  criteria as shown in equation (1).

$$a_{ij} = \begin{bmatrix} d_{11} & d_{21} & d_{i1} \\ d_{12} & d_{22} & d_{i2} \\ d_{1j} & d_{j2} & d_{ij} \end{bmatrix} \quad (1)$$

Step 2 A standardised matrix  $S_{ij}$  is obtained by using equation (2).

$$S_{ij} = \frac{d_{ij}}{\left(\sum_j d_{ij}^2\right)^{1/2}}, \quad \forall i, j \quad (2)$$

Step 3 Weights ( $w_i$ ) for each criterion are developed. The weighted normalised matrix is constructed using equation (3).

$$V_{ij} = w_i S_{ij}, \quad \forall i, j \quad (3)$$

However, if all the criteria are equally weighted then it will be exactly the same matrix as step 2.

Step 4 The positive ideal solution and negative-ideal solution are found using equations (4) and (5)

$$\text{Ideal solution } V^* = \{\max(V_{ij})\} \quad \forall i \quad (4)$$

$$\text{Negative ideal solution } V' = \{\min(V_{ij})\} \quad \forall i \quad (5)$$

Step 5 The separation measure ( $S_i^*$ ) from positive ideal solutions for each alternative is calculated as shown in equation (6).

$$S_i^* = \sum_j \left( (V^* - V_{ij})^2 \right)^{1/2} \quad \forall i \quad (6)$$

Step 6 The separation measure ( $S_i'$ ) from negative ideal solution for each alternative is calculated as shown in equation (7).

$$S_i' = \sum_j \left( (V' - V_{ij})^2 \right)^{1/2} \quad \forall i \quad (7)$$

Step 7 The closeness index is computed using equation (8) and banks are ranked in descending order of the index value

$$C_i^* = \frac{S_i'}{(S_i' + S_i^*)} \quad \forall i \quad (8)$$

Now, the methodology of TOPSIS explained in the above section is used to rank the banks for their possible way out of PCA based upon the four criteria: total regulatory capital minimum ratio including capital conservation buffer (CCB), NNPA's to net advances ratio, RoA, tier-1 capital/average consolidated assets.

As a first step, the performance of the banks is taken against all the criteria shown in Table 4a. The weighted average is considered to consolidate data from previous periods, whereas more weightage is given to recent time periods than earlier ones as provided below:

- FY 15–16: 15%
- FY 16–17: 15%
- FY 17–18: 15%
- FY 18–19 (first quarter): 15%
- FY 18–19 (second quarter): 20%
- FY 18–19 (third quarter): 20%.

In Step 2, each value in Table 4a is divided by  $(\sum_j d_{ij}^2)^{1/2}$  to standardise the given values. Standardised matrix is given in Table 4b.

As all four ratios are equally important criteria hence, the above standardised matrix is used for further procedure in Step 3.

From the given standardised matrix used in Step 3, the ideal solution is obtained as  $V^* = \{0.34124668, 0.47037560, 0.37255534, 0.33513645\}$  and negative ideal solution is obtained as  $V' = \{0.25325399, 0.15014345, 0.14548132, 0.23676644\}$  in Step 4.

Using the ideal solution and negative ideal solution, in Step 5, a separation matrix is computed from ideal solution (shown in Table 4c) and total separation of each bank from ideal solution is calculated as  $S_i^*$ .

Similarly, in Step 6, the separation of each bank from negative ideal solution is computed (shown in Table 4d) and total separation is obtained as  $S_i'$ .

**Table 4a** Weighted average of performance data

<i>Bank</i>	<i>Total CRAR ratio including CCB</i>	<i>Net NPAs to net advances ratio*</i>	<i>ROA</i>	<i>Tier1 capital/avg consolidated assets</i>
1 Allahabad Bank	9.39	12.21	3.30	3.77
2 Bank of India	12.41	12.71	3.97	4.61
3 Bank of Maharashtra	10.71	10.46	2.44	4.38
4 CBI	9.38	9.98	3.90	3.89
5 Corporation Bank	10.37	9.67	4.84	4.61
6 Dena Bank	10.67	9.57	3.73	4.70
7 Dhan Laxmi Bank	12.24	16.98	4.37	4.56
8 IDBI Bank	10.01	5.42	1.89	4.25
9 IOB	9.21	5.97	3.88	4.04
10 OBC	11.22	11.04	4.58	4.94
11 United Bank of India	10.28	7.10	3.55	3.49
12 UCO Bank	9.48	8.53	3.51	3.52
<i>SUM of squares</i>	<i>1,322.5335</i>	<i>1,303.1242</i>	<i>168.7754</i>	<i>217.2754</i>
$(\sum_j d_{ij}^2)^{1/2}$	<i>36.3666</i>	<i>36.0988</i>	<i>12.9913</i>	<i>14.7402</i>

Note: \*NPA is a negative ratio, hence, a positive number 20 is added to all NPA values to convert them into positive data.

**Table 4b** Standardised matrix

<i>Sr no.</i>	<i>Bank</i>	<i>CRAR including CCB</i>	<i>Net NPAs to net advances</i>	<i>ROA</i>	<i>Tier1 capital/avg consolidated assets</i>
1	Allahabad Bank	0.25820358	0.33823828	0.25401500	0.25576203
2	Bank of India	0.34124668	0.35208915	0.30558775	0.31274880
3	Bank of Maharashtra	0.29450056	0.28976023	0.18781715	0.29714528
4	CBI	0.25792860	0.27646339	0.30019955	0.26390300
5	Corporation Bank	0.28515134	0.26787585	0.37255534	0.31274880
6	Dena Bank	0.29340065	0.26510568	0.28711393	0.31885452
7	Dhan Laxmi bank	0.33657207	0.47037560	0.33637744	0.30935673
8	IDBI Bank	0.27525216	0.15014345	0.14548132	0.28832590
9	IOB	0.25325399	0.16537941	0.29866006	0.27407921
10	OBC	0.30852440	0.30582724	0.35254203	0.33513645
11	United Bank of India	0.28267654	0.19668237	0.27325856	0.23676644
12	UCO Bank	0.26067837	0.23629587	0.27017959	0.23880168
	<i>V*</i> (positive ideal solution)	0.34124668	0.47037560	0.37255534	0.33513645
	<i>Vi</i> (negative ideal solution)	0.25325399	0.15014345	0.14548132	0.23676644

**Table 4c** Separation matrix from positive ideal solution  $S_i^*$ 

<i>Sr no.</i>	<i>Bank</i>	<i>CRAR including CCB</i>	<i>Net NPAs to net advances</i>	<i>ROA</i>	<i>Tier1 capital/avg consolidated assets</i>	$\sum_j (V^* - V_{ij})^2 * 1,000$	$S_i^* = \frac{\sum_j ((V^* - V_{ij})^2)^{1/2}}{1,000}$
1	Allahabad Bank	6.89615	17.46026	14.05181	6.30029	44.70853	0.00669
2	Bank of India	0.00000	13.99168	4.48465	0.50120	18.97754	0.00436
3	Bank of Maharashtra	2.18519	32.62190	34.12819	1.44332	70.37863	0.00839
4	CBI	6.94190	37.60194	5.23536	5.07420	54.85341	0.00741
5	Corporation Bank	3.14668	41.00614	0.00000	0.50120	44.65404	0.00668
6	Dena Bank	2.28924	42.13573	7.30023	0.26510	51.99031	0.00721
7	Dhan Laxmi Bank	0.02185	0.00000	1.30884	0.66459	1.99528	0.00141
8	IDBI Bank	4.35527	102.54860	51.56260	2.19122	160.65774	0.01268
9	IOB	7.74271	93.02267	5.46051	3.72798	109.95388	0.01049
10	OBC	1.07074	27.07616	0.40053	0.00000	28.54744	0.00534
11	United Bank of India	3.43046	74.90797	9.85984	9.67665	97.87494	0.00989
12	UCO Bank	6.49125	54.79331	10.48079	9.28038	81.04575	0.00900



**Table 4d** Separation matrix from negative ideal solution  $S'_i$ 

<i>Sr.</i>	<i>Bank</i>	<i>Total regulatory capital minimum ratio including CCB</i>	<i>Net NPAs to net advances ratio</i>	<i>ROA</i>	<i>Tier1 capital/avg consolidated assets</i>	$\sum_j (V^i - V_{ij})^2 * 1,000$	$S'_i = \frac{\sum_j ((V^i - V_{ij})^2)^{1/2}}{1,000}$
1	Allahabad Bank	0.02449	35.37966	11.77956	0.36083	47.5446	0.00690
2	Bank of India	7.74271	40.78206	25.63406	5.77331	79.9322	0.00894
3	Bank of Maharashtra	1.70128	19.49284	1.79232	3.64560	26.6321	0.00516
4	CBI	0.02185	15.95672	23.93773	0.73639	40.6527	0.00638
5	Corporation Bank	1.01744	13.86091	51.56260	5.77331	72.2143	0.00850
6	Dena Bank	1.61175	13.21631	20.05979	6.73845	41.6263	0.00645
7	Dhan Laxmi bank	6.94190	102.54860	36.44132	5.26934	151.201	0.01230
8	IDBI Bank	0.48391	0.000000	0.00000	2.65837	3.1423	0.00177
9	IOB	0.00000	0.23213	23.46372	1.39224	25.0881	0.00501
10	OBC	3.05481	24.23744	42.87413	9.67665	79.8431	0.00894
11	United Bank	0.86568	2.16587	16.32702	0.00000	19.3586	0.00440
12	UCO Bank	0.05512	7.4222	15.54965	0.00414	23.0312	0.00480

**Table 4e** Relative closeness index  $C_i^*$  and the ranks obtained

<i>Bank</i>	$S_i^*$	$S'_i$	$C_i^* \text{ relative closeness index } S'_i / (S_i^* + S'_i)$	<i>Rank as per relative closeness index</i>	
1	Allahabad Bank	0.00669	0.00690	0.507687250	5
2	Bank of India	0.00436	0.00894	0.672378158	2
3	Bank of Maharashtra	0.00839	0.00516	0.380862934	8
4	CBI	0.00741	0.00638	0.462619998	7
5	Corporation Bank	0.00668	0.0085	0.559799054	4
6	Dena Bank	0.00721	0.00645	0.472237974	6
7	Dhan Laxmi Bank	0.00141	0.01230	0.896961658	1
8	IDBI Bank	0.01268	0.00177	0.122694139	12
9	IOB	0.01049	0.00501	0.323259246	10
10	OBC	0.00534	0.00894	0.625801739	3
11	United Bank of India	0.00989	0.00440	0.307831391	11
12	UCO Bank	0.00900	0.00480	0.347718534	9

In Step 7, using the separation values from ideal and negative ideal solutions the relative closeness index is computed for each bank as  $C_i^*$ . The ranks obtained are shown in Table 4e.

**Table 4f** Rank comparison table for all the three indices

Bank	Wtd. average composite index		TOPSIS closeness index		*Normalised average rank $[(1)+(2)+(3)]/3$		Normalised ranking order list	
	Rank	Bank	Rank	Bank	Rank	Bank	Rank	Bank
	(1)	(2)	(3)	(4)	(5)			
Allahabad Bank	6	Allahabad Bank	5	Allahabad Bank	6	Dhan Laxmi Bank	1	
Bank of India	2	Bank of India	2	Bank of India	2	Bank of India	2	
Bank of Maha	7	Bank of Maha	8	Bank of Maha	7	OBC	3	
CBI	8	CBI	7	CBI	8	Corn Bank	4	
Corn Bank	4	Corn Bank	4	Corn Bank	4	Dena Bank	5	
Dena Bank	5	Dena Bank	6	Dena Bank	5	Allahabad Bank	6	
Dhan Laxmi Bank	1	Dhan Laxmi Bank	1	Dhan Laxmi Bank	1	Bank of Maharashtra	7	
IDBI Bank	12	IDBI Bank	12	IDBI Bank	12	CBI	8	
IOB	11	IOB	10	IOB	11	UCO Bank	9	
OBC	3	OBC	3	OBC	3	United Bank	10	
United Bank	10	United Bank	11	United Bank of India	10	IOB	11	
UCO Bank	9	UCO Bank	9	UCO Bank	9	IDBI Bank	12	

## 6 Analysis, discussions and findings

This work ranks the banks on the basis of capital adequacy, asset quality, RoA and leverage ratio using weighted average index, weighted average deviation index, TOPSIS and normalised rank order list.

### 6.1 Null hypothesis

Moving out of PCA framework is independent of the ranking of the banks based on capital adequacy, asset quality, earnings and leverage ratio of a bank.

### 6.2 Analysis

We may test the hypothesis by comparing financial position of banks under PCA in FY 15–16, FY 16–17, FY17–18 and the first three quarters of FY 18–19 on the trigger parameters collectively. We have presented the combined results of the above three methods in Table 4f, which gives a clear comparison at a glance.

The ranking of financial strength of banks based on weighted average index and weighted average deviation index has been found exactly the same. This has led to the belief that both the indices appear to be effective and corroborate each other in predicting the recovery of these banks vis-à-vis each other in times to come as per their rank. Under TOPSIS closeness index, six banks have the same rank but other six have only one position lower or higher in rank as compared to other two methods. However, we have normalised the ranks by averaging all the three rankings given by the three different indices in the last column (4)\* of Table 4f.

### 6.3 Decision of RBI on PCA banks after results of Q-3 of FY 18–19

Immediately after the financial results of Q3 of FY 18–19 of the banks, on 31 January 2019, Dhan Laxmi Bank (rank 1), Bank of India (rank 2), Oriental Bank of Commerce (rank 3) and Bank of Maharashtra (rank 7) were taken out of the PCA framework by RBI. On 26 February 2019, again RBI lifted PCA curbs on Corporation Bank (rank 4) and Allahabad Bank (Ranked 6). It is worth noting that within a span of two months, that is, January and February 2019, RBI took out six banks from PCA framework. These are the same six banks that ranked from 1 to 7. Dena Bank (rank 5) was decided to be merged with a stronger bank, Bank of Baroda effective from 1 April 2019. This merger was an experiment of merging one weak bank with two strong banks, namely, Bank of Baroda and Vijaya bank, so that the merged entity still remained financially strong even after absorbing losses of Dena Bank due to its high NPAs.

In case of remaining banks, e.g., Central Bank of India (rank 8), UCO Bank (rank 9), United Bank of India (rank 10), Indian Overseas Bank (rank 11), and IDBI Bank (rank 12), the CRAR and CET1 ratio remained below the required level, NNPA ratio remained in double digits and RoA continued to be negative. No improvement was in sight in any parameter. Hence, they were kept under the PCA framework.

#### 6.4 Testing of null hypothesis

The above result rejects our null hypothesis and implies that the ranking based on capital adequacy, earnings, asset quality and leverage ratio, influences the bank on getting out of the PCA framework.

#### 6.5 T-test on comparing the mean of the ranks of banks under PCA framework and out of PCA framework

The work has ranked the banks on the basis of 'capital adequacy, asset quality, return on assets and leverage ratio' using weighted average index, weighted average deviation index, TOPSIS and normalised rank order list. Thereafter, t-test on comparing the mean of the ranks of banks under PCA framework and out of the PCA framework was also performed. The results are given in Tables 5a to 5f.

**Table 5a** Rankings under weighted average index

<i>Banks out of PCAs</i>	<i>Weighted average rank</i>	<i>Banks still under PCA</i>	<i>Weighted average rank</i>
Bank of India	2	CBI	8
Bank of Maharashtra	7	IDBI Bank	12
Dhan Laxmi Bank	1	IOB	11
Corporation Bank	4	United Bank of India	10
Allahabad Bank	6	UCO Bank	9
OBC	3		

**Table 5b** t-test results of ranking under weighted average index

<i>t-test: two-sample assuming unequal variances</i>			<i>t-test: two-sample assuming equal variances</i>		
<i>Item</i>	<i>Banks out of PCA</i>	<i>Banks under PCA</i>	<i>Item</i>	<i>Banks out of PCA</i>	<i>Banks under PCA</i>
Mean	3.833333	10	Mean	3.833333	10
Variance	5.366667	2.5	Variance	5.3666666	2.5
Observations	6	5	Observations	6	5
<i>Null hypothesis results</i>					
Hypothesised mean diff.		0	Hypothesised mean diff.		0
df		9	df		9
t stat		-5.0340	t stat		-5.03402
P ( $T \leq t$ ) one-tail		0.0004	P ( $T \leq t$ ) one-tail		0.000352
t critical one-tail		1.8331	t critical one-tail		1.8331
P ( $T \leq t$ ) two-tail		0.0007	P ( $T \leq t$ ) two-tail		0.00070
t critical two-tail		2.2622	t critical two-tail		2.2621

**Table 5c** Ranking as per weighted deviation index

<i>Banks out of PCA</i>	<i>TOPSIS rank</i>	<i>Banks under PCA</i>	<i>TOPSIS rank</i>
Allahabad Bank	6	CBI	8
Bank of India	2	IDBI Bank	12
Bank of Maharashtra	7	IOB	11
Corporation Bank	4	United Bank	10
Dhan Laxmi bank	1	UCO Bank	9
OBC	3		

**Table 5d** t-test results of ranking under weighted deviation index

<i>t-test: two-sample assuming unequal variances</i>			<i>t-test: two-sample assuming equal variances</i>		
<i>Item</i>	<i>Banks out of PCA</i>	<i>Banks under PCA</i>	<i>Item</i>	<i>Banks out of PCA</i>	<i>Banks under PCA</i>
Mean	3.833333	10	Mean	3.8333	10.0000
Variance	5.366667	2.5	Variance	5.3667	2.5000
Observations	6	5	Observations	6.0000	5.0000
<i>Null hypothesis results</i>					
Hypothesised mean diff.		0	Hypothesised mean diff.		0
df		9	df		9
t stat		-5.0340	t stat		-5.0340
P ( $T \leq t$ ) one-tail		0.0004	P ( $T \leq t$ ) one-tail		0.0004
t critical one-tail		1.8331	t critical one-tail		1.8331
P ( $T \leq t$ ) two-tail		0.0007	P ( $T \leq t$ ) two-tail		0.0007
t critical two-tail		2.2622	t critical two-tail		2.2622

**Table 5e** Ranking as per TOPSIS index

<i>Banks out of PCA</i>	<i>TOPSIS rank</i>	<i>Banks under PCA</i>	<i>TOPSIS rank</i>
Allahabad Bank	5	CBI	7
Bank of India	2	IDBI Bank	12
Bank of Maharashtra	8	IOB	10
Dhan Laxmi Bank	1	United Bank of India	11
OBC	3	UCO Bank	9
Corn Bank	4		

**Table 5f** t-test results of ranking under TOPSIS methodology

<i>t-test: two-sample assuming unequal variances</i>			<i>t-test: two-sample assuming equal variances</i>		
<i>Item</i>	<i>Banks Out of PCA</i>	<i>Banks under PCA</i>	<i>Item</i>	<i>Banks Out of PCA</i>	<i>Banks under PCA</i>
Mean	3.833	9.800	Mean	3.8333	9.8000
Variance	6.167	3.700	Variance	6.1667	3.7000
Observations	6	5	Observations	6	5
<i>Null hypothesis results</i>					
Hypothesised mean diff.		0.0000	Hypothesised mean diff.		0.0000
df		9.0000	df		9
t stat		-4.4876	t stat		-4.3760
P ( $T \leq t$ ) one-tail		0.0008	P ( $T \leq t$ ) one-tail		0.0009
t critical one-tail		1.8331	t critical one-tail		1.8331
P ( $T \leq t$ ) two-tail		0.0015	P ( $T \leq t$ ) two-tail		0.0018
t critical two-tail		2.2622	t critical two-tail		2.2622

**Table 5g** Ranking as per normalised index

<i>Banks out of PCA</i>	<i>Normalised rank</i>	<i>Banks under PCA</i>	<i>Normalised rank</i>
Dhan Laxmi Bank	1	CBI	8
Bank of India	2	UCO Bank	9
OBC	3	United Bank of India	10
Bank of Maharashtra	7	IOB	11
Corporation Bank	4	IDBI Bank	12
Allahabad Bank	6		

**Table 5h** t-test results of ranking under normalised index

<i>t-test: two-sample assuming unequal variances</i>			<i>t-test: two-sample assuming equal variances</i>		
<i>Item</i>	<i>Banks out of PCA</i>	<i>Banks under PCA</i>	<i>Item</i>	<i>Banks out of PCA</i>	<i>Banks under PCA</i>
Mean	3.833333	10	Mean	3.8333	10
Variance	5.366666	2.5	Variance	5.3667	2.5
Observations	6	5	Observations	6.0000	5
<i>Null hypothesis results</i>					
Hypothesised mean diff.		0.0000	Hypothesised mean diff.		0
df		9.0000	df		9
t stat		-5.2222	t stat		-5.0340
P ( $T \leq t$ ) one-tail		0.0003	P ( $T \leq t$ ) one-tail		0.0004
t critical one-tail		1.8331	t critical one-tail		1.8331
P ( $T \leq t$ ) two-tail		0.0005	P ( $T \leq t$ ) two-tail		0.0007
t critical two-tail		2.2622	t critical two-tail		2.2622

## 6.6 *t*-test inferences for all the ranking methods

The *t*-test shows that the mean rank of the banks out of the PCA framework is significantly less than mean rank of the banks still under the PCA framework. This rejects our null hypothesis and implies that the influence of ranking, based on capital adequacy, earnings, asset quality and leverage ratio, on getting out of the PCA framework, cannot be rejected.

## 7 Policy implications of findings of the study

### 7.1 *Implications for the management*

The findings of the study are relevant for the top management or members of the board of directors of banks who have better knowledge of the affairs and the financial position of the bank than the regulator. The study strongly signals that the regulatory guidelines and prudential norms should be strictly followed by banks' boards as an integral part of risk management. They must review proactively the financial position on various relevant parameters, as suggested by the model presented in the study, at short and regular intervals, as detailed in the current study, to self-detect any risks and to minimise losses, even before the same is done by the regulator.

### 7.2 *Implications for the society or community*

The study has suggested a model to determine comparative strength of banks in distress and needing timely attention and priority to the banks ranked the lowest in financial position and so on. In case the same is not done and one or more banks fail, the savers lose full or part of their deposits that brings agony for the society where already there is so many struggles for people to sustain their livelihoods. Further, the bank failure affects the confidence adversely in entire financial system, reduces savings and investments and leads to slowing economic growth hurting everyone in the process. Even if the failing banks are bailed out, the taxpayer's money is used that diverts funds from more important social or other projects or causes.

The banking system is one of the few institutions that hugely impacts the economy and affects its performance for the better or the worse. They act as the development agency and are the source of hope and aspiration of the masses (Soden, 1992). With a view to achieve some social and economic goals, it is necessary to have a clean, diversified, viable, efficient and low-cost banking system fully committed to growth with justice.

### 7.3 *Implications for the regulator*

Banking system imparts financial stability, facilitates efficient financial services and aids in financial inclusion. Monetary policy transmission in the Indian economy also takes place through banks. Good financial health of the banking industry remains a top priority of the regulator for obvious reasons.

The study suggests, through a statistical model, that the regulator must review the financial position on all the relevant parameters collectively instead of only one of the

five parameters. The suggested model presents a much better system of regulation to detect the risks of failure of banks. This also helps the regulator to take prompt remedial measures and help in setting the priority of action based on ranking generated by the model to avert any full-blown financial crisis beyond the point of no return.

## 8 Future directions for research

The government's capital infusion seeks to mend the capital ratios of weak banks under PCA and also helps them make provisions to bring down the NNPA ratio to below 6%. The reduction in NPAs will improve profitability, leading in turn to improvement in the RoA. In a nutshell, fresh money should enable banks to get the numbers to exit PCA. The Ministry of Finance, Government of India, has asked the five public sector banks still under PCA to improve on seven parameters to get the government's capital support for coming out of the PCA framework, i.e., net interest margins (NIMs), current account savings account (CASA), risk weighted assets (RWAs), NPA recognition, divergence (disparity in loan recognition), operating profit and non-core asset selling.

There is a substantial scope for future studies on these remaining five banks under PCA in the coming years to observe how they perform on the seven parameters mandated by RBI. It will also be interesting to see whether these banks are taken out of the PCA framework by RBI and in which sequence and/or whether some of them or all of them are merged into stronger banks. This will lend strong credence to the model applied in the current study if further studies also provide similar findings.

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## Notes

- 1 Revised prompt corrective action (PCA) framework for banks: RBI Circular No. RBI/2016-17/276 DBS.CO.PPD; BC. No. 8/11.01.005/2016-17 (13 April 2017) – all scheduled commercial banks (excluding regional rural banks) revised PCA framework.

**Appendix 1****Table 6** PCA MATRIX – areas, indicators and risk thresholds as on 31 March 2017

<i>Area</i>	<i>Indicator</i>	<i>Risk threshold 1</i>	<i>Risk threshold 2</i>	<i>Risk threshold 3</i>
Capital (breach of either CRAR or CET 1 ratio to trigger PCA)	CRAR-Min. regulatory capital to risk assets ratio + capital conservation buffer (CCB) 1.25%* (total min. 10.25%)	Up to 250 bps below indicator 7.75 - <10.25%	250–400 bps below indicator	-
	<i>And/or</i> Pre-specified trigger of common equity tier 1 CET 1 min 5.5% + CCB 1.25%* (total 6.75%)	Up to 162.50 bps below indicator 5.125 - <6.75%	6.25 - <7.75% >162.50–312.50 bps below indicator	- >312.50 bps below indicator
Asset quality	NPA-Ratio (net non-performing advances to net advances)	6.0 - <9.0%	9.0 - <12.0%	>= 12.0%
Profitability	Return on assets (ROA) (net profits to total assets ratio)	Negative ROA for 2 consecutive years	Negative ROA for 3 consecutive years	Negative ROA for 4 consecutive years
Leverage	Tier 1 leverage ratio <sup>a</sup> (CET 1/Avg. consolidated assets)	<=4.0% to 3.5% (leverage >25 times the tier 1 capital)	< 3.5% (leverage > 28.6 times the tier 1 capital)	-

Notes: <sup>a</sup><https://www.rbi.org.in/scripts/NotificationUser.aspx?Mode=0&Id=10921#F4>.

\*CCB would be 1.875% and 2.5% as on 31 March 2018 and 31 March 2019 respectively.

*CET 1 ratio* is defined as the percentage of core equity capital, net of regulatory adjustments, to total risk weighted assets as defined in RBI BASEL III guidelines.

**Appendix 2***Mandatory actions*

- *Risk threshold 1*: restriction on dividend distribution/remittance of profits. Promoters/owners/parent in the case of foreign banks to bring in capital.
- *Risk threshold 2*: in addition to mandatory actions of threshold 1, restriction on branch expansion; domestic and/or overseas, higher provisions as part of the coverage regime.
- *Risk threshold 3*: in addition to mandatory actions of thresholds 1 and 2, restriction on branch expansion; domestic and/or overseas, restriction on management compensation and directors' fees, as applicable.

Breach of 'risk threshold 3' of CET 1 by a bank would identify a bank as a likely candidate for resolution through tools like amalgamation, reconstruction, winding up, etc. In the case of a default on the part of a bank in meeting the obligations to its depositors, possible resolution processes may be resorted to without reference to the PCA matrix.

*Discretionary actions: special supervisory interventions*

Strategy related, governance related, capital related, credit risk related, market risk related, hr related, profitability related, operations related, any other.