Chapter II

Financial Institutions: Soundness and Resilience

The business of scheduled commercial banks (SCBs) slowed significantly during 2015-16. The gross non-performing advances (GNPAs) ratio increased sharply, largely reflecting reclassification of restructured standard advances as non-performing. Consequently, the restructured standard advances ratio declined but with a marginal increase in the overall stressed advances ratio from 11.3 per cent in September 2015 to 11.5 per cent in March 2016. The capital to risk-weighted assets ratio (CRAR) of SCBs showed some improvement. Public sector banks (PSBs) continued to record the lowest CRAR among the bank groups with steep decline in their profitability.

Asset quality of scheduled urban co-operative banks (SUCBs) as well as non-banking financial companies (NBFCs) improved. The performance of NBFC sector in general is relatively better than that of PSBs.

As per the banking stability indicator, risks to the banking sector increased significantly during the second half of 2015-16 due to deteriorating asset quality and lower profitability. While stress tests reveal resilience, the system could become vulnerable if the macroeconomic conditions were to deteriorate sharply.

Given the higher level of balance sheet impairment, banks may remain risk averse for some more time as their focus would be on strengthening balance sheet. Moreover, their capital position may impact their ability to meet credit delivery.

Section I

Scheduled commercial banks[1]

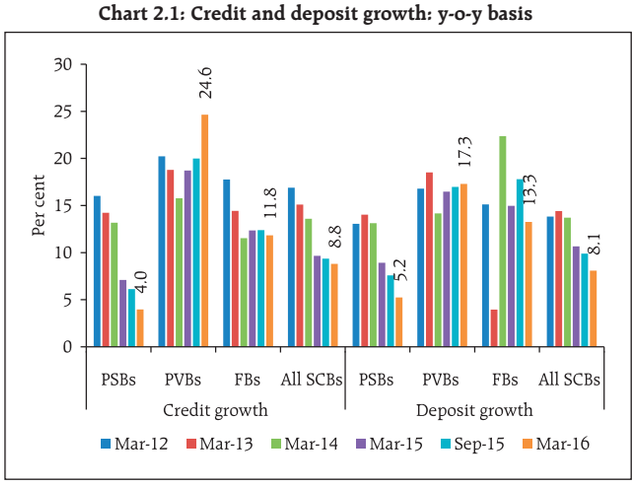
2.1 In this section, the soundness and resilience of scheduled commercial banks[2] (SCBs) are discussed under two broad sub-heads: a) performance on functional aspects, and b) resilience using macro-stress tests through scenarios and single factor sensitivity analysis.

Performance

Credit and deposit growth

2.2 Overall credit and deposit growth of SCBs remained in single digits because of subdued performance of the public sector banks (PSBs). Credit growth of all SCBs, on a y-o-y basis, declined to 8.8 per cent in March 2016 from 9.4 per cent in September 2015 while the growth in deposit declined to 8.1 per cent from 9.9 per cent. The relative performance of bank groups reflects their respective strengths amidst on-going industry-wide balance sheet repair and also sluggish growth in private capex (Chart 2.1).

Chart 2.1: Credit and deposit growth: y-o-y basis

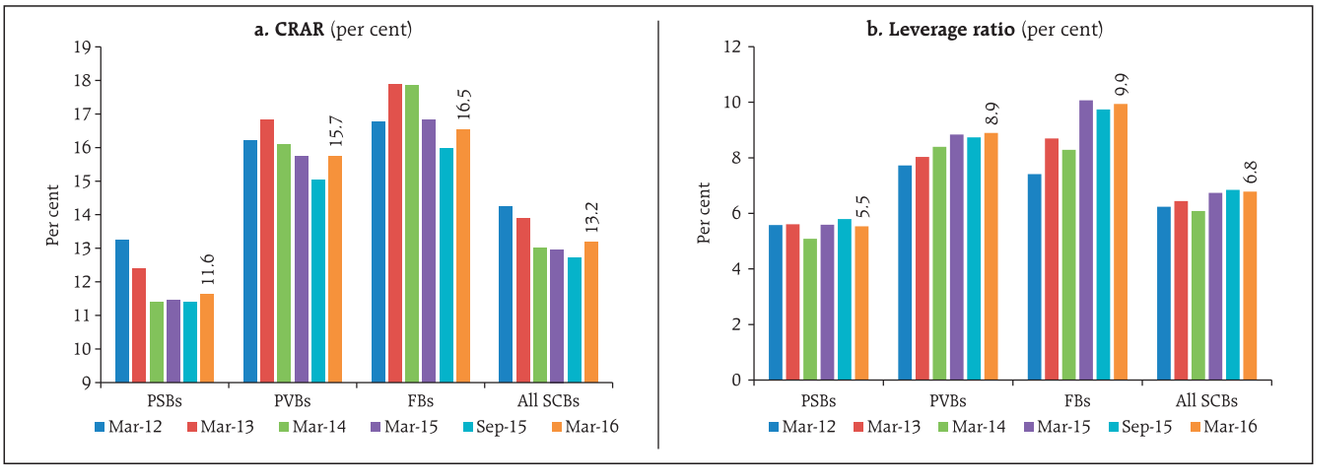


Note: PSBs: Public sector banks, PVBs: Private sector banks, FBs: Foreign banks.
Source: RBI supervisory returns.

[1] Analyses undertaken in the chapter are based on latest available data which are provisional.

[2] Analyses are based on supervisory returns which cover only domestic operations of SCBs, except in case of data on large borrowers, which is based on banks' global operations. SCBs include public sector, private sector and foreign banks.

Chart 2.2: Capital adequacy and leverage ratio



Source: RBI supervisory returns.

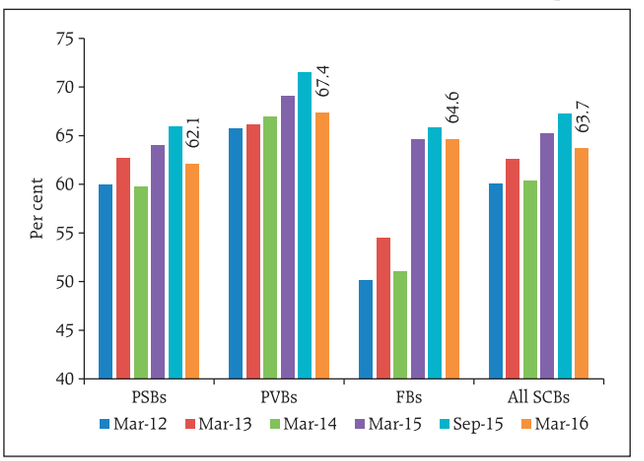
Capital, leverage and risk-weighted assets

2.3 The capital to risk-weighted assets ratio (CRAR) of SCBs at the system level as well as bank-group level increased between September 2015 and March 2016. However, the Tier-I leverage ratio[3] remained unchanged at 6.8 per cent during the same period (Chart 2.2).

2.4 The risk-weighted assets (RWAs) density[4] of all SCBs, which was showing an upward trend earlier, declined from 67.2 per cent to 63.7 per cent between September 2015 and March 2016. The decline was broad based (Chart 2.3).

Chart 2.3: RWAs density

(per cent)



Source: RBI supervisory returns.

Asset quality

2.5 The gross non-performing advances[5] (GNPAs) of SCBs sharply increased to 7.6 per cent of gross advances from 5.1 per cent between September 2015 and March 2016 after the asset quality review (AQR) [see paragraphs 3.8 to 3.9 in Chapter III]. A simultaneous sharp reduction in restructured standard advances ratio from 6.2 per cent to 3.9 per cent during the same period resulted in the overall stressed advances[6] ratio

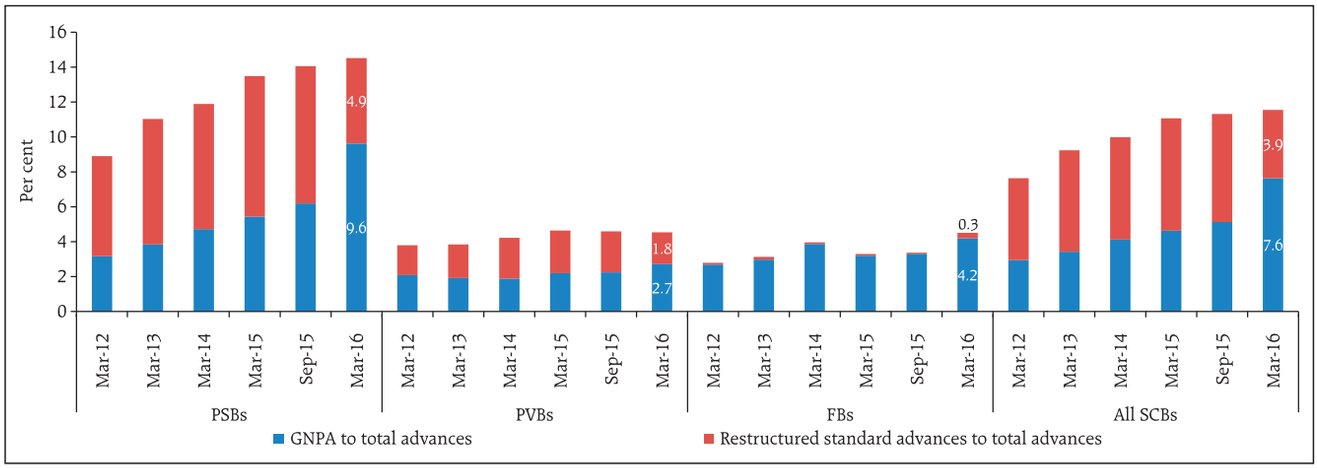
[3] Tier-I leverage ratio is defined as the ratio of Tier-I capital to total assets. Total assets include the credit equivalent of off-balance sheet items.

[4] RWAs density is defined as the ratio of total RWAs to total assets. Total assets include the credit equivalent of off-balance sheet items.

[5] Here, 'advances' and 'loans' have been used interchangeably.

[6] For the purpose of analysing the asset quality, stressed advances are defined as GNPAs plus restructured standard advances.

Chart 2.4: Asset quality of SCBs



Source: RBI supervisory returns.

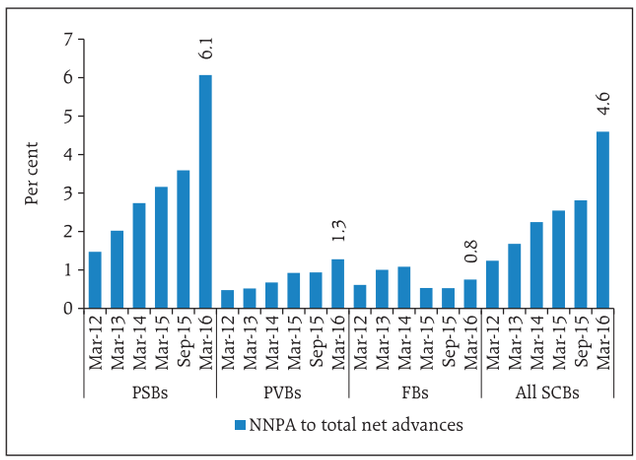
rising marginally to 11.5 per cent from 11.3 per cent during the period. PSBs continued to hold the highest level of stressed advances ratio at 14.5 per cent, whereas, both private sector banks (PVBs) and foreign banks (FBs), recorded stressed advances ratio at 4.5 per cent (Chart 2.4).

2.6 The net non-performing advances (NNPAs) as a percentage of the total net advances for all SCBs increased considerably to 4.6 per cent from 2.8 per cent between September 2015 and March 2016. At the bank group level, the NNPA ratio increased from 3.6 per cent to 6.1 per cent for PSBs, from 0.9 per cent to 1.3 per cent for PVBs and from 0.5 per cent to 0.8 per cent for FBs during the same period (Chart 2.5).

2.7 Subsequent to AQR, the banking sector GNPAs showed a sharp y-o-y increase of 79.7 per cent in March 2016. Large increases were observed across bank-groups (Chart 2.6).

2.8 Probability density functions show that a significant number of banks shifted from lower GNPA ratios to higher GNPA ratios during the last year, whereas, distribution of banks based on the stressed advances ratio did not change much. This suggests

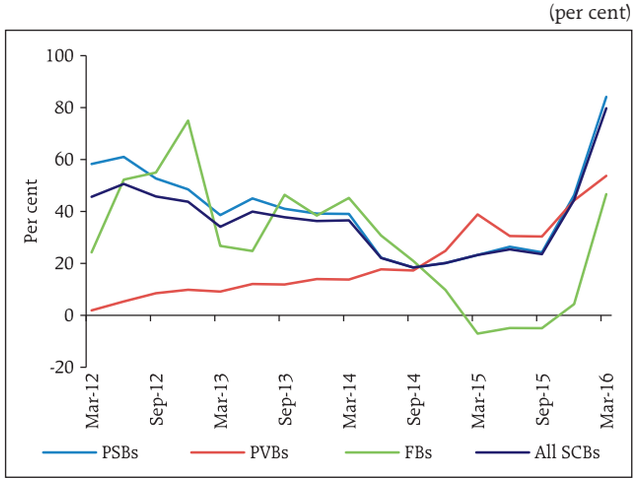
Chart 2.5: NNPAs of SCBs



Source: RBI supervisory returns.

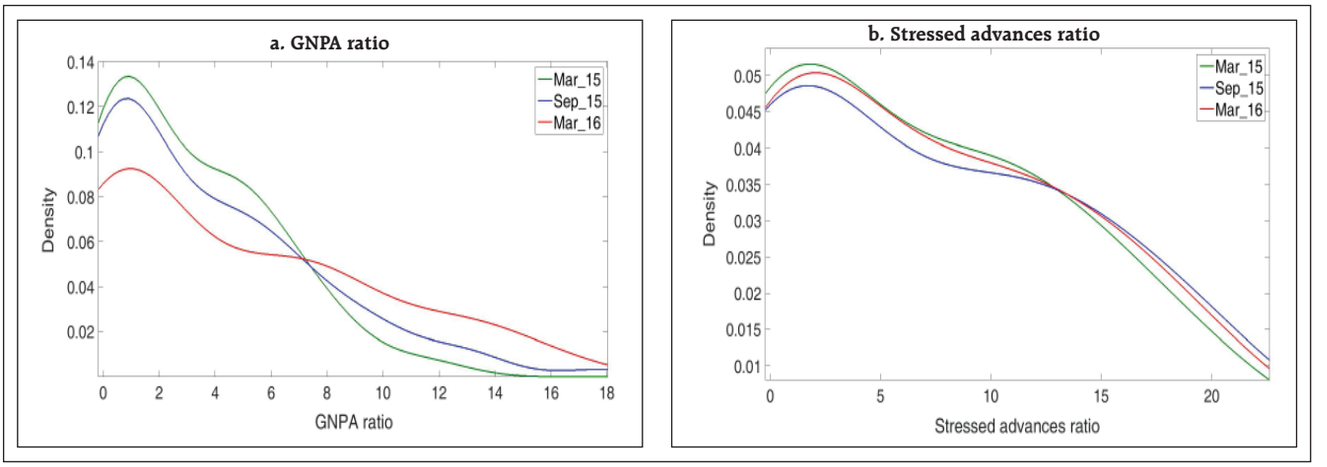
Chart 2.6: Y-o-Y growth of GNPA

(per cent)



Source: RBI supervisory returns.

Chart 2.7: Probability density function of asset quality



Note: The probability distribution was derived using non-parametric Kernel Density Estimate.
Source: RBI supervisory returns and staff calculations.

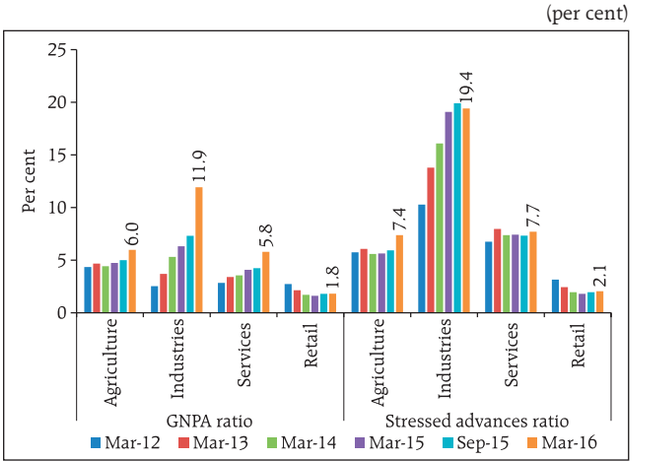
that increasing proportion of restructured advances are reckoned as non-performing (Chart 2.7).

2.9 Amongst major sectors, the industrial sector showed a decline in the stressed advances ratio from 19.9 per cent to 19.4 per cent between September 2015 and March 2016, though the GNPA ratio of the sector increased sharply to 11.9 per cent from 7.3 per cent. Retail loans continued to witness the least stress (Chart 2.8).

2.10 Among the major sub-sectors within the industrial sector, 'basic metal and metal products' accounted for the highest stressed advances ratio as of March 2016 followed by 'construction' and 'textiles'. It is notable that the stressed advances ratio of the 'infrastructure' sector declined to 16.7 per cent from 21.8 per cent between September 2015 and March 2016 (Chart 2.9).

Chart 2.8: Asset quality in major sectors

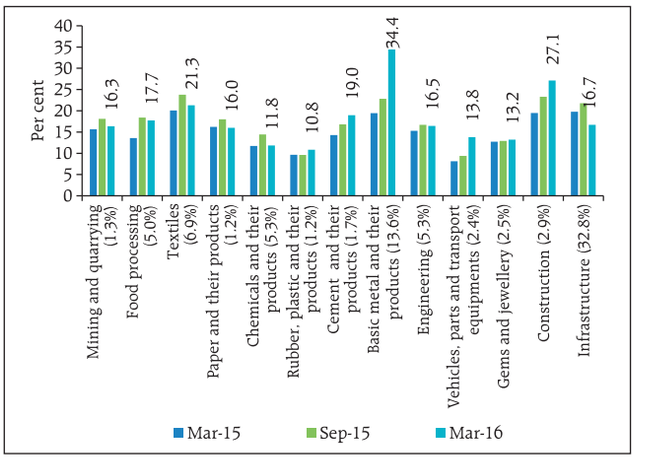
(per cent)



Source: RBI supervisory returns.

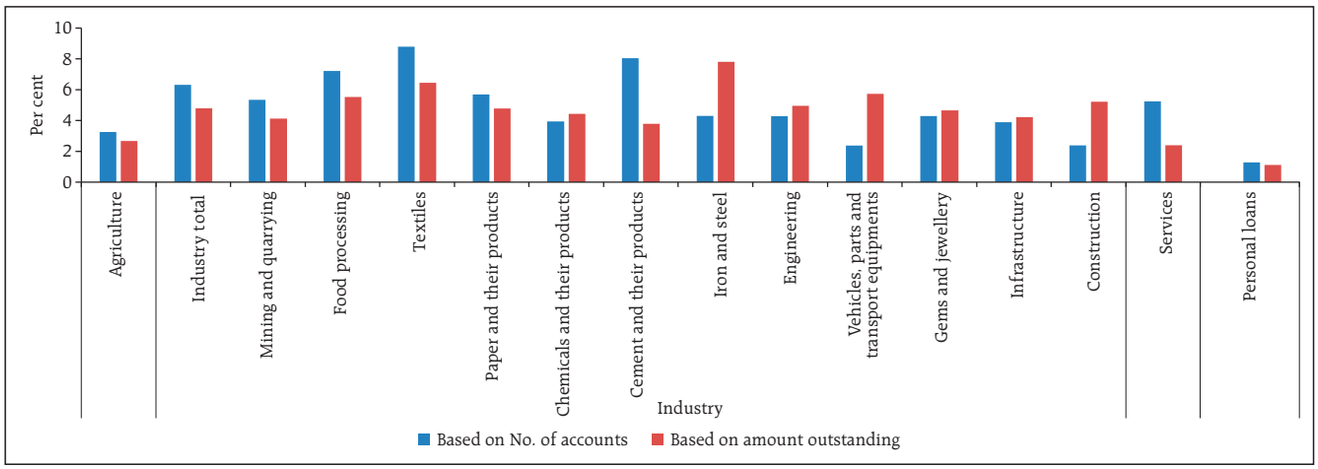
Chart 2.9: Stressed advances ratios of major sub-sectors within industry

(per cent of advances of their respective sector)



Note: Numbers given in parenthesis with the legend are share of the respective sub-sector's credit in total credit to industry.
Source: RBI supervisory returns.

Chart 2.10: Annual slippage of standard accounts to NPA category-Sector wise
(January to December 2015)



Source: Basic Statistical Returns, RBI.

2.11 On the other hand, annual slippages of major sectors/sub-sectors in December 2015[7] show that the textiles industry had the highest number of standard accounts slipping into the NPA category at 8.8 per cent, followed by the cement industry at 8.0 per cent. In terms of outstanding amounts, the iron and steel industry saw the highest slippages at 7.8 per cent followed by textiles at 6.4 per cent (Chart 2.10). In this context, to address the prevailing stress in various sectors, the Government has taken several measures (Box 2.1).

Box 2.1: Stress in banking sector - Recent measures taken by the Government

The Government has taken many initiatives to expedite recovery of bad loans. The initiatives include establishment of six new Debt Recovery Tribunals (DRTs) as also those mentioned below:

In the case of distressed steel sector, import duty for steel products was increased, additional safeguard duty was imposed and a minimum import price was stipulated. In addition, auction of long term coal linkages is being envisaged.

In order to address the issue of stalled projects in the case of road sector, provisions were made to substitute 'concessionaire' at the instance of lenders through approval by National Highways Authority of India (NHAI) to provide exit even during construction period. Concessionaires were also permitted to divest 100 per cent equity two years after commercial operational date (COD). Further NHAI would intervene with one time fund infusion in languishing projects affected by lack of funds so that they can be completed. NHAI has also approved premium recast of several distressed road projects. New structures such as Hybrid Annuity Model and Toll-Operate-Transfer Model are being tried besides facilitating project implementations by de-linking of statutory clearances such as environmental/ forest clearance.

For the power sector, a scheme[8] to strengthen the financial and operational aspects of distribution companies (Discoms) was introduced. The scheme envisages take-over of 75 per cent of the debt of Discoms by the respective state governments. Besides improving the process of providing coal linkages and auctioning of coal blocks, the Government has also started auctioning re-gasified liquefied natural gas (RLNG) along with providing support through power system development fund (PSDF) to stranded gas-based power projects.

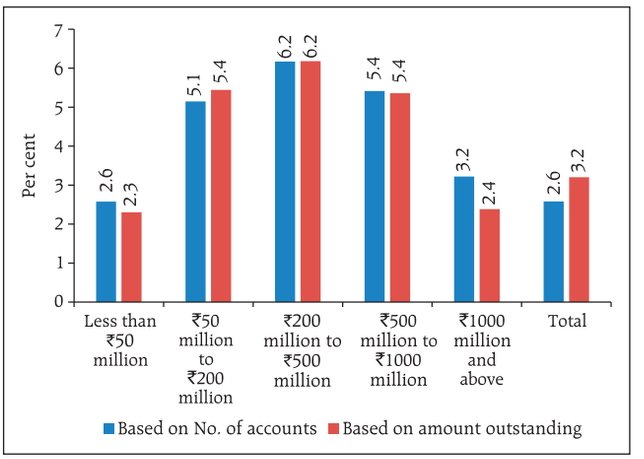
An "Amended Technology Up-gradation Fund Scheme" has been envisaged to provide one time capital subsidy for investments in the employment and technology intensive segments of the textile value chain to deal with issues relating to textile industry.

[7] Annual slippage was calculated as ratio of standard advances turning into NPAs during the period to standard advances at the beginning of the period. The sectoral slippage data was taken from Banking Statistical Return, RBI. The latest data available was till December 2015.

[8] Ujwal DISCOM Assurance Yojana (UDAY).

2.12 In terms of size, loans in the range of ₹200 million to ₹500 million recorded the highest slippages at 6.2 per cent during 2015 based both on the number of accounts and amount outstanding. These were followed by the loans in the range of ₹500 million to ₹1000 million. Overall slippage ratio based on amount outstanding was 3.2 per cent (Chart 2.11).

Chart 2.11: Slippage of standard accounts to NPA category –Loan size wise
(January to December 2015)



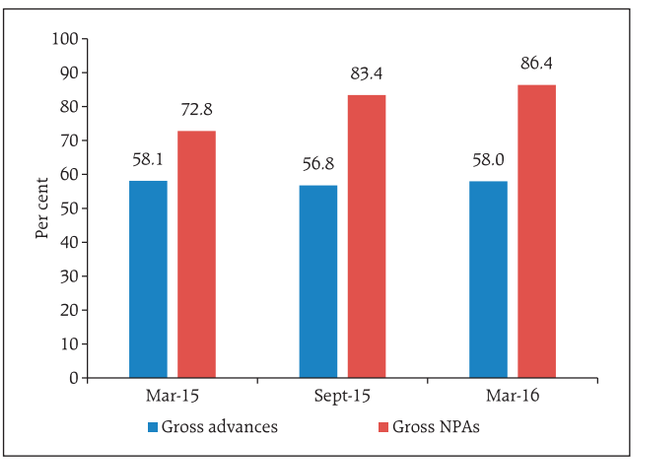
Source: Basic Statistical Returns, RBI.

Credit quality of large borrowers[9]

2.13 As a part of sustained efforts to address NPAs in the banking sector, the Central Repository of Information on Large Credits[10] (CRILC) is collecting and disseminating data. The system has been further strengthened to capture red flagged accounts, fraud accounts, updates on positions of special mention accounts-2[11] (SMA-2), status of the joint lenders' forum (JLF) and non-cooperative borrowers. The system has fairly stabilised and banks are using the data for monitoring their large borrowers' asset quality and also for credit appraisal of prospective borrowers.

2.14 Share of large borrowers' in total loans increased from 56.8 per cent to 58.0 per cent between September 2015 and March 2016. Their share in GNPAs also increased from 83.4 per cent to 86.4 per cent during the same period (Chart 2.12).

Chart 2.12: Share of large borrowers in SCBs' loan portfolio



Source: RBI supervisory returns.

2.15 Advances to large borrowers classified as SMA-2 declined sharply by 40.5 per cent and restructured standard advances declined by 25.0 per cent between September 2015 and March 2016, simultaneously pushing up their GNPAs by 66.3 per cent, largely reflecting reclassification. Advances to large borrowers classified as SMA-1 (early signs of stress in asset quality), however, increased sharply by 35.1 per cent

[9] A large borrower is defined as a borrower who has aggregate fund-based and non-fund based exposure of ₹50 million and above.

[10] The CRILC database reflects banks' global operations.

[11] Before a loan account turns into an NPA, banks are required to identify incipient stress in the account by creating three sub-asset category of SMA: i) SMA-0: Principal or interest payment not overdue for more than 30 days but account showing signs of incipient stress, ii) SMA-1: Principal or interest payment overdue between 31-60 days, and, iii) SMA-2: Principal or interest payment overdue between 61-90 days.

between September 2015 and March 2016 (Chart 2.13).

2.16 The GNPA ratio of large borrowers increased sharply from 7.0 per cent to 10.6 per cent during September 2015 to March 2016 and the increase was evident across all bank groups. In this respect, PSBs recorded the highest GNPA ratio at 12.9 per cent. On the other hand, SMA-2 ratio of large borrowers declined across bank-groups during the same period (Chart 2.14).

2.17 The share of standard advances in total funded amount outstanding of large borrowers declined from 84.1 per cent to 83.2 per cent between September 2015 and March 2016. Top 100 large borrowers (in terms of outstanding funded amounts) accounted for 27.9 per cent of credit to all large borrowers and 16.2 per cent of the credit of all SCBs. There was a sharp increase in the share of GNPAs of top 100 large borrowers in GNPAs of all large borrowers from 3.4 per cent in September 2015 to 22.3 per cent in March 2016 reflecting again reclassification (Table 2.1).

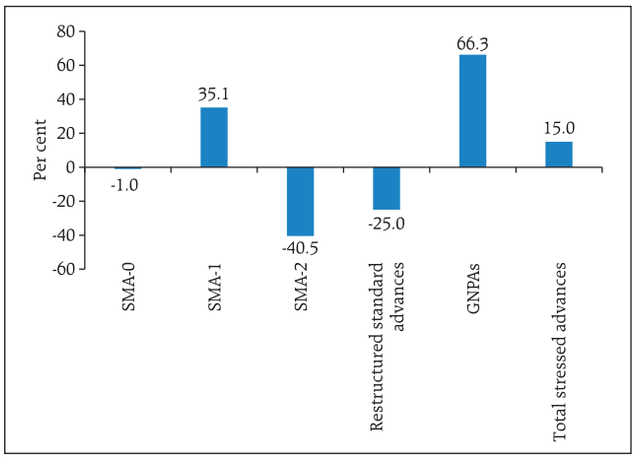
Table 2.1: Exposure of SCBs to large borrowers

(per cent)

	Mar-15	Sep-15	Mar-16*
Composition of total funded amount outstanding of large borrowers			
i. Standard	86.2	84.1	83.2
ii. Restructured standard	8.4	8.9	6.2
ii. Sub-standard	1.7	2.0	3.3
iv. Doubtful	3.0	4.2	6.6
v. Loss	0.7	0.8	0.7
Top 100 borrowers			
i. Fund-based amount outstanding to total fund-based amount outstanding of large borrowers	28.1	27.5	27.9
ii. Fund-based amount outstanding to total gross advances of SCBs	18.3	15.6	16.2
iii. GNPAs to total GNPAs of large borrowers	0.8	3.4	22.3
iv. GNPAs to total GNPAs of SCBs	0.7	2.9	19.3

Note: * Provisional data.
Source: RBI supervisory returns.

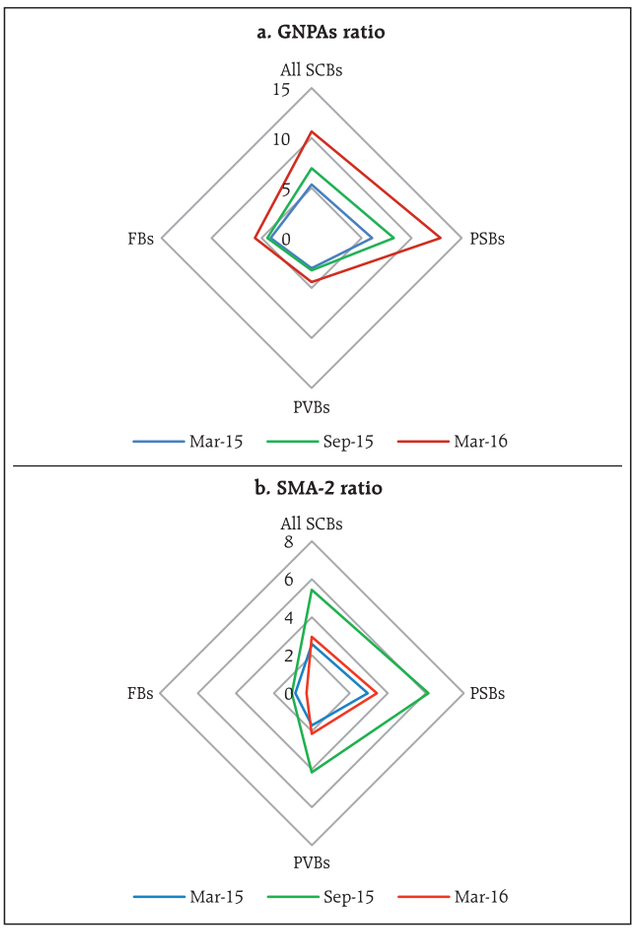
Chart 2.13: Percentage change in the asset quality of large borrowers between September-15 and March-16



Source: RBI supervisory returns.

Chart 2.14: GNPA and SMA-2 of large borrowers

(per cent of gross advances)



Source: RBI supervisory returns.

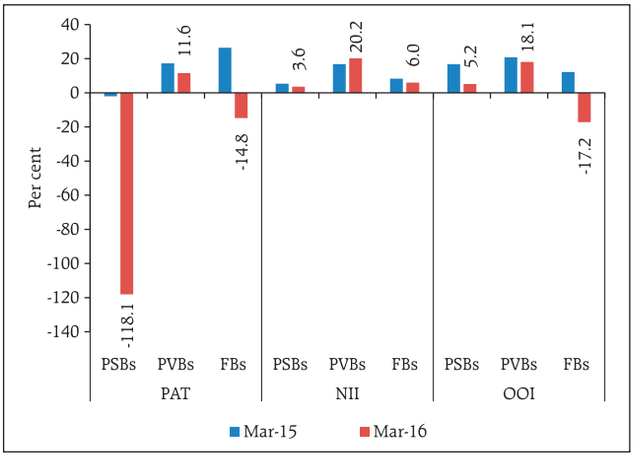
Profitability

2.18 Both return on assets (RoA) and return on equity (RoE) of SCBs declined sharply to 0.4 per cent and 4.8 per cent, respectively, in March 2016 from 0.8 per cent and 9.3 per cent in March 2015. Profit after tax (PAT) declined by 43.0 per cent during the financial year 2015-16, due to sharp increase in risk provisions and write-off (Table 2.2).

2.19 Among the bank-groups, PSBs recorded a loss during 2015-16 whereas PVBs showed 11.6 per cent growth in PAT on a y-o-y basis (Chart 2.15).

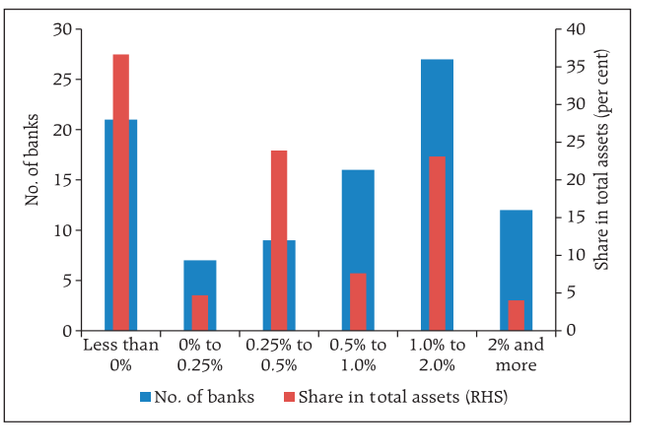
2.20 A bank-wise distribution of RoAs (annual) shows that 21 SCBs with a share of 37 per cent in the total assets of SCBs recorded negative RoAs during the financial year 2015-16. Further, seven banks with a share of 5 per cent in the total assets recorded RoAs in the range of 0 to 0.25 per cent (Chart 2.16).

Chart 2.15: Components of income: y-o-y growth



Note: NII=net interest income, OOI=other operating income.
Source: RBI supervisory returns.

Chart 2.16: Distribution of SCBs based on RoAs (annual)
(March 2016)



Note: The median RoA (annual) as of March 2016 was 0.76 per cent.
Source: RBI supervisory returns.

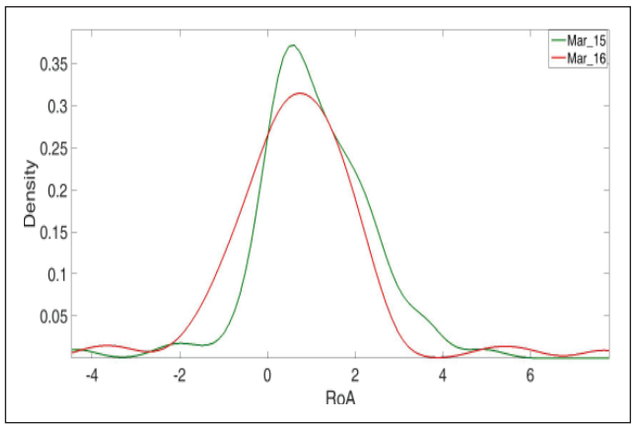
Table 2.2: Profitability of SCBs

(per cent)

	RoA	RoE	Y-o-Y growth					
			PAT	Earnings Before Provisions & Taxes	Net Interest Income	Other Operating Income	Risk Provisions	Write-off
Mar-12	1.1	13.4	14.6	15.3	15.8	7.4	35.6	-13.1
Mar-13	1.0	12.9	12.9	9.9	10.8	14.4	10.2	-8.5
Mar-14	0.8	9.5	-14.1	9.5	11.7	16.6	41.9	80.3
Mar-15	0.8	9.3	10.1	11.4	8.5	17.4	7.0	23.4
Mar-16	0.4	4.8	-43.0	11.9	8.3	6.7	86.2	27.3

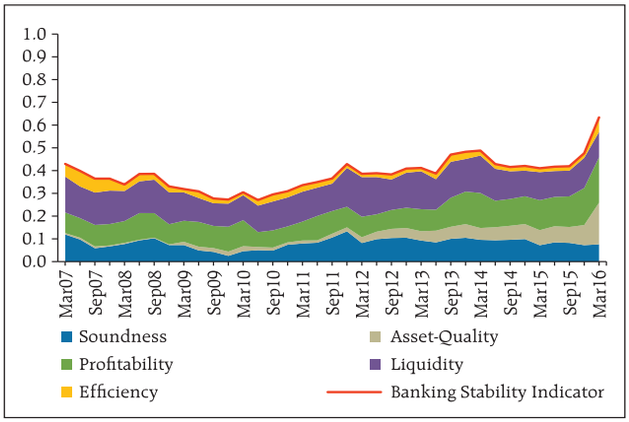
Note: RoA and RoE are annual figures, whereas the growth is calculated on a y-o-y basis.
Source: RBI supervisory returns.

Chart 2.17: Probability density function of RoAs



Note: The probability distribution was derived using non-parametric Kernel Density Estimate.
Source: RBI supervisory returns and staff calculations.

Chart 2.18: Banking stability indicator



Note: Increase in indicator value shows lower stability. The width of each dimension signifies its contribution towards risk.
Source: RBI supervisory returns and staff calculations.

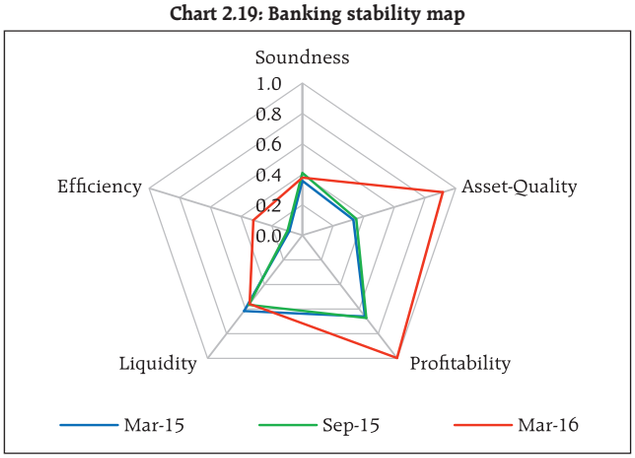
2.21 The probability density function of bank-wise RoAs shows that more banks had lower RoAs in 2015-16 as compared to 2014-15 (Chart 2.17).

Risks

Banking stability indicator

2.22 The banking stability indicator (BSI),[12] shows that risks to the banking sector have sharply increased since the publication of the previous FSR.[13] A trend analysis of BSI suggests that stability conditions in the banking sector which started deteriorating in mid-2010, have now worsened significantly. The factors contributing to an increase in risks during the half-year ended March 2016 are deteriorating asset quality and low profitability (Charts 2.18 and 2.19).

Chart 2.19: Banking stability map



Note: Away from the centre signifies increase in risk.
Source: RBI supervisory returns and staff calculations.

Resilience - Stress tests

Macro stress test-Credit risk[14]

2.23 The resilience of the Indian banking system against macroeconomic shocks was subjected to a series of macro stress tests for credit risk at the system, bank-group and sectoral levels. These tests encompassed assumed risk scenarios incorporating a

[12] The detailed methodology and basic indicators used under different BSI dimensions are given in Annex 2.
[13] FSR, December 2015 (with reference to data as at end September 2015).
[14] The detailed methodology is given in Annex 2.

baseline and two adverse macroeconomic scenarios representing medium and severe risks. The adverse scenarios were derived based on up to one standard deviation (SD) for medium risk and up to two SD for severe risk (10 years historical data) (Table 2.3).[15]

Table 2.3: Macroeconomic scenario assumptions (2016-17)[16]

(per cent)

Macro factors	Baseline	Medium Stress	Severe Stress
Growth in GVA at basic price	7.6	5.5	2.9
Gross fiscal deficit to GDP ratio	3.5	4.6	5.9
CPI (combined) inflation	5.1	6.9	9.1
Weighted average lending rate	11.3	11.9	12.6
Merchandise exports to GDP ratio	12.6	11.1	9.3
Current account balance to GDP ratio	-1.3	-2.4	-4.8

Note: GVA=Gross value added.

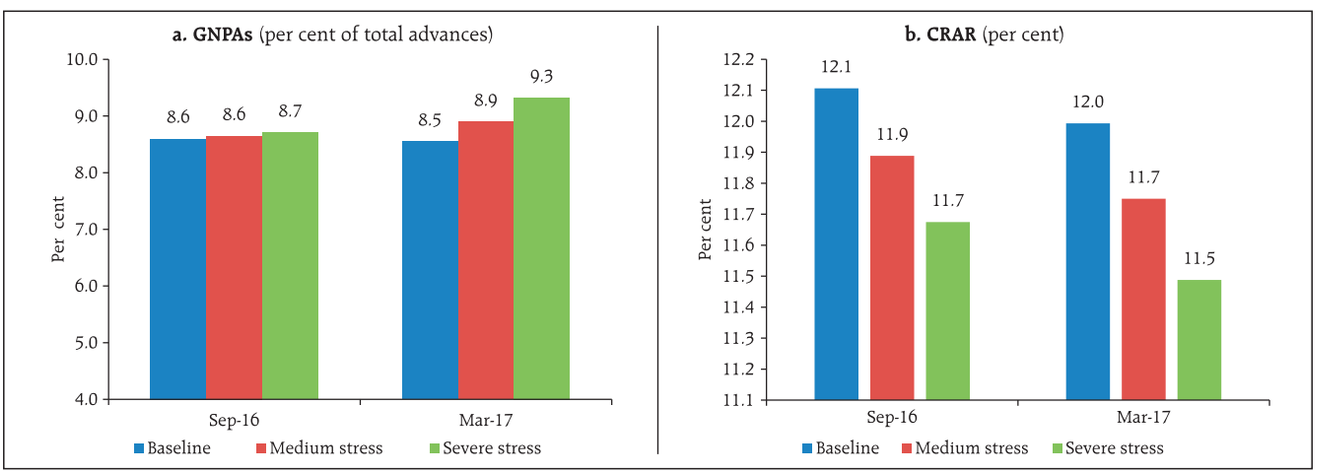
Credit risk[17]

2.24 The macro stress tests suggest that under the baseline scenario, the GNPA ratio may rise to 8.5 per cent by March 2017 from 7.6 per cent in March 2016. If the macro scenarios deteriorate in the future, the GNPA ratio may further increase to 9.3 per cent by March 2017 under a severe stress scenario. Under such a severe stress scenario, the system level CRAR of SCBs may decline to 11.5 per cent by March 2017 from 13.2 per cent as of March 2016 (Chart 2.20).

2.25 Among the bank-groups, PSBs may continue to register the highest GNPA ratio. Under the baseline scenario, their GNPA ratio may go up to 10.1 per cent by March 2017 from 9.6 per cent as of March 2016. However, under a severe stress scenario, it may increase to 11.0 per cent by March 2017. Under the baseline scenario, the GNPA ratio of PVBs may increase to 3.1 per cent by March 2017 from 2.7 per cent as of March 2016, which could further increase to 4.2 per cent under a severe stress scenario. Under a severe stress scenario, PSBs may record the lowest

Chart 2.20: Projection of system level GNPA ratios and CRAR of SCBs

(under various scenarios)



Note: 1. The projection of system level GNPAs was done using three different, but complementary econometric models: *multivariate regression, vector autoregression* (which takes into account the feedback impact of credit quality to macro variables and interaction effects) and *quantile regression* (which can deal with tail risks and takes into account the non-linear impact of macroeconomic shocks). The average GNPA ratio of these three models is given in the chart.

2. CRAR projections are made under a conservative assumption of minimum profit transfer to capital reserves at 25 per cent. It does not take into account any capital infusion by stakeholders.

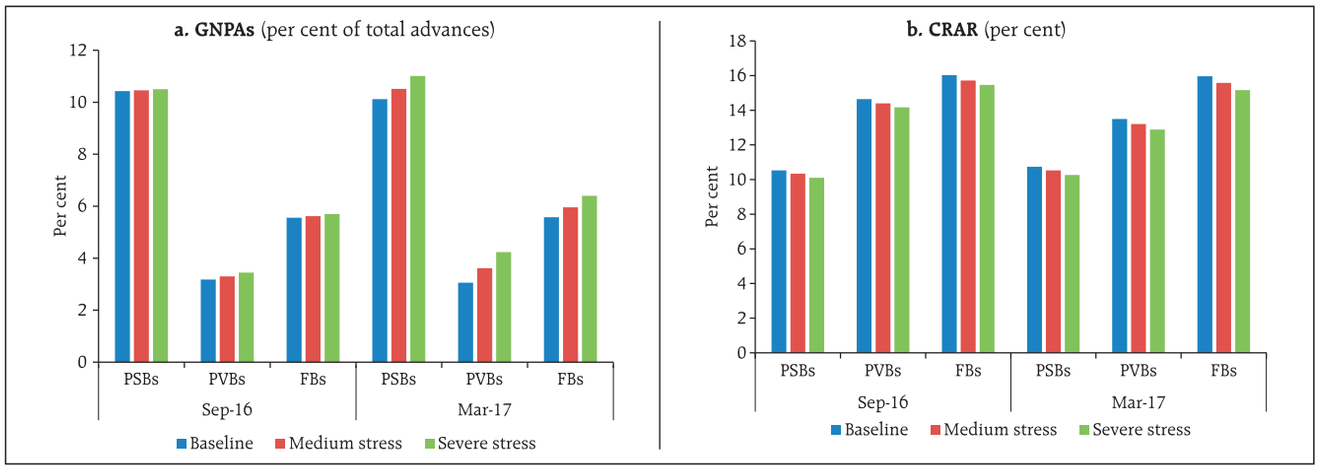
Source: RBI supervisory returns and staff calculations.

[15] The quantum of shocks (as a multiplier of standard deviation) increased with time (quarterly period).

[16] These stress scenarios are stringent and conservative assessments which are hypothetical. The severe adverse economic conditions referred to here should not be interpreted as forecast or expected outcomes.

[17] Projection of the GNPA ratio is based on assumption that there will be further NPA recognition (in the post-AQR scenario) which is also a contributing factor for the projected GNPA ratio at a future date.

Chart 2.21: Projection of bank-group wise GNPA ratio and CRAR (under various scenarios)



Note: 1. The projection of bank groups-wise GNPA was done using two different but complementary econometric models: *multivariate regression* and *vector autoregression*. The average GNPA ratio of these two models is given in the chart.
2. CRAR projections are made under a conservative assumption of minimum profit transfer to capital reserves at 25 per cent. It does not take into account any capital infusion by stakeholders.

Source: RBI supervisory returns and staff calculations.

CRAR of around 10.3 per cent by March 2017, as against 11.6 per cent as of March 2016 (Chart 2.21).

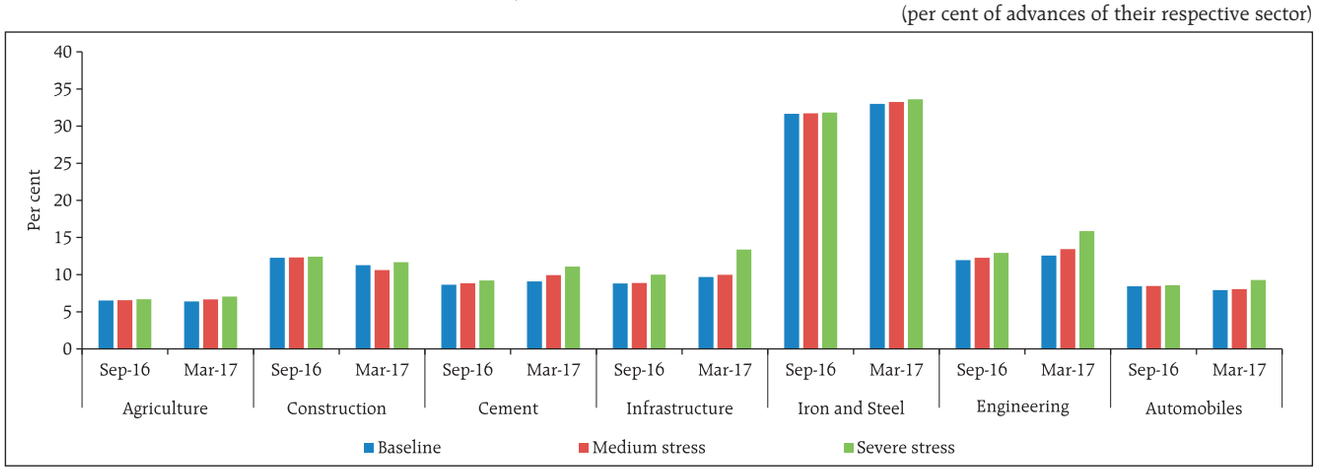
2.26 A macro stress test of sectoral credit risk revealed that in a severe stress scenario, among the select seven sectors, iron and steel industry (which had the highest GNPA ratio at 30.4 per cent as of March 2016) could see its GNPA ratio moving up to 33.6 per cent by March 2017 followed by engineering (from 10.9 per cent to 15.9 per cent) and infrastructure (from 7.1 per cent to 13.4 per cent) [Chart 2.22].

Sensitivity analysis: Bank level[18]

2.27 A number of single factor sensitivity stress tests[19] (top-down) were carried out on SCBs[20] to assess

Chart 2.22: Projected sectoral GNPAs under various scenarios

(per cent of advances of their respective sector)



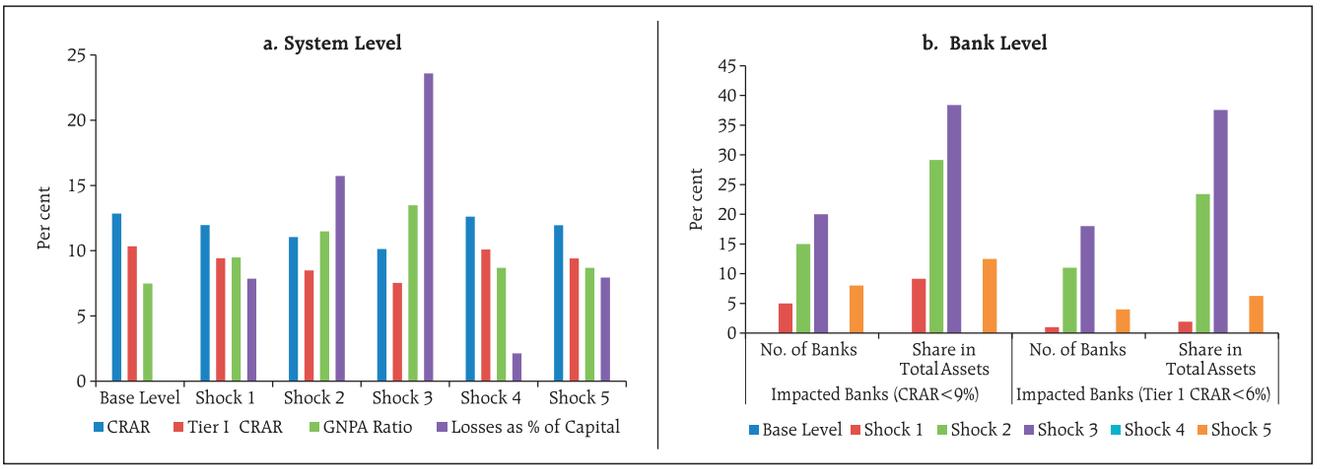
Source: RBI supervisory returns and staff calculations.

[18] The sensitivity analysis was undertaken in addition to macro stress tests for credit risk. While in the former shocks were given directly to asset quality (GNPAs), in the latter the shocks were in terms of adverse macroeconomic conditions. Also, macro stress tests were done at the system, major bank group and sectoral levels, whereas the sensitivity analysis was done at aggregated system and bank levels. While the focus of the macro stress tests was credit risk, the sensitivity analysis covered credit, interest rate and liquidity risks.

[19] For details of the stress tests, see Annex 2.

[20] Single factor sensitivity analysis stress tests were conducted for a sample of 60 SCBs accounting for 99 per cent assets of the total banking sector.

Chart 2.23: Credit risk - shocks and impacts



Shock 1: 1 SD shock on GNPAs
Shock 2: 2 SD shock on GNPAs
Shock 3: 3 SD shock on GNPAs
Shock 4: 30 per cent of restructured advances turn into GNPAs (sub-standard category)
Shock 5: 30 per cent of restructured advances turn into GNPAs (loss category) - written off

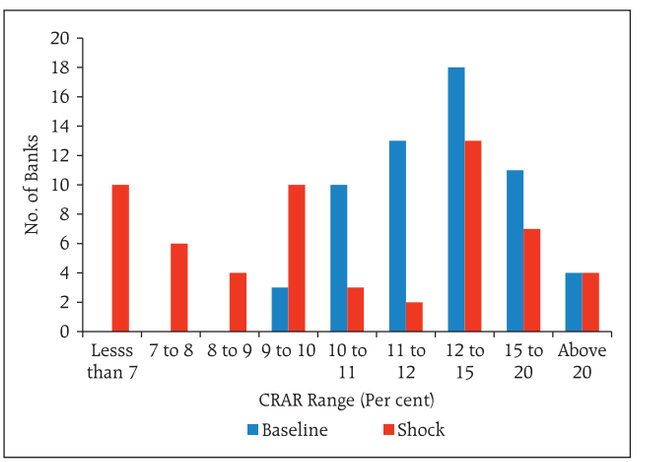
Note: System of select 60 SCBs.
Source: RBI supervisory returns and staff calculations.

their vulnerabilities and resilience under various scenarios[21]. The resilience of SCBs with respect to credit, interest rate and liquidity risks was studied through the top-down sensitivity analysis by imparting extreme but plausible shocks. The same set of shocks was used on select SCBs to conduct bottom-up stress tests. The results are based on March 2016 data.

Credit risk

2.28 The impact of different static credit shocks for banks showed that system level CRAR remained above the required minimum of 9 per cent. Under severe shock of 3 SD[22] (that is, if the average GNPA ratio of 60 select SCBs moves up to 13.5 per cent from 7.5 per cent), the system level CRAR and Tier-1 CRAR declined to 10.1 per cent and 7.5 per cent, respectively. The capital losses at the system level could be around 23.6 per cent under a severe shock. The impact of these shocks on profit will be more severe with the SCBs losing their entire annual profit of 2015-16 if the GNPA ratio moves up by 0.74 SD to 9.0 per cent. At the individual bank-level, the stress test results show that 20 banks having a share of 38.4 per cent of SCBs' total assets might fail to maintain the required CRAR under the shock of a large 3 SD increase in GNPAs. PSBs were found to be severely impacted in these stress tests, where, CRAR of 17 PSBs fall below 9 per cent (Charts 2.23 and 2.24).

Chart 2.24: CRAR-wise distribution of banks
(under 3 SD shock on GNPA ratio)



Note: System of select 60 SCBs.
Source: RBI supervisory returns and staff calculations.

[21] The shocks designed under various hypothetical scenarios are extreme but plausible.

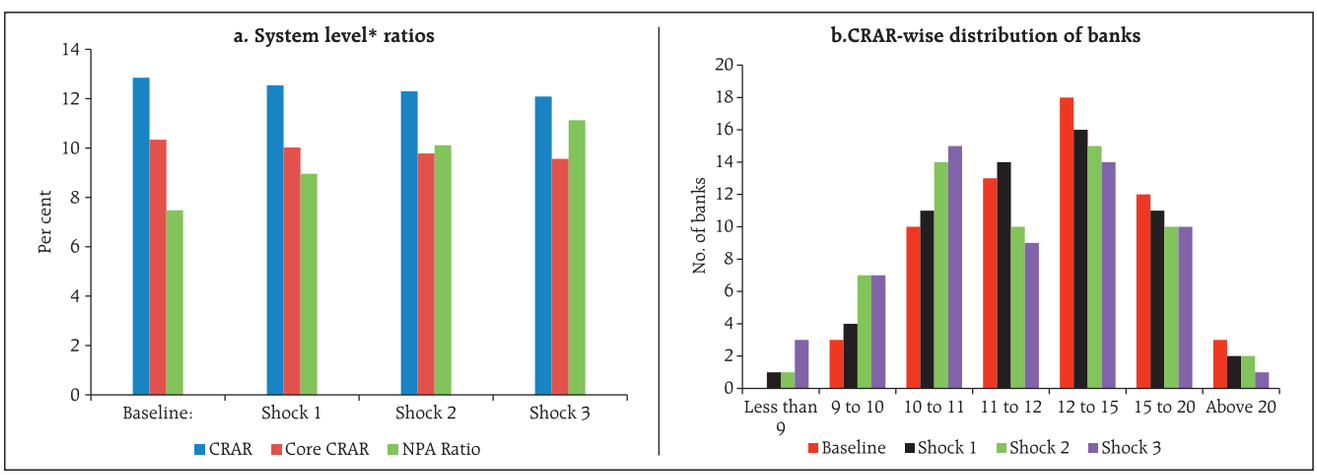
[22] The SD of the GNPA ratio is estimated using the quarterly data since 2003. One SD shock approximates to 27 per cent increase in GNPAs.

Credit concentration risk

2.29 Stress tests on banks' credit concentration risks, considering top individual borrowers according to their exposures, showed that the impact[23] (under three different scenarios) was significant for three banks, comprising about 5.3 per cent of the assets, which may fail to maintain 9 per cent CRAR in at least one of the scenarios. Capital losses under the assumed scenarios of default of the top individual borrower could be around 3 per cent. Default of the top two individual borrowers could result in capital losses of 5 per cent, while 6 per cent losses could occur in case the three top individual borrowers default. The impact on profit before tax (PBT) could be 112 per cent in case of default of the top three individual borrowers. The losses could be 45 per cent of PBT under the scenarios of default of topmost individual borrower and 81 per cent in case the top two individual borrowers default. The impact on CRAR at the system level under the assumed scenarios of default of the top one, two and three individual borrowers will be 31, 55 and 76 basis points (Chart 2.25).

2.30 Stress tests on banks' credit concentration risks, considering top individual borrowers according to their stressed advances showed that the impact[24] (under three different scenarios) was significant for 8 banks, comprising about 12.1 per cent of the assets, which may fail to maintain 9 per cent CRAR in at least one of the scenarios. Capital losses under the assumed scenarios of failure of the top stressed borrower could be around 4 per cent. Failure of the top two stressed borrowers could result in capital losses of 6.9 per cent, while 9.4 per cent losses could occur in case the top three stressed borrowers fail. The impact on PBT could be 162 per cent for failure of the top three stressed borrowers. The losses could be 70 per cent of PBT under the scenarios of default of topmost stressed borrower and 120 per cent in case the top two stressed borrowers fail. The impact on CRAR at the system level under the assumed

Chart 2.25: Credit concentration risk: Individual borrowers – Exposure



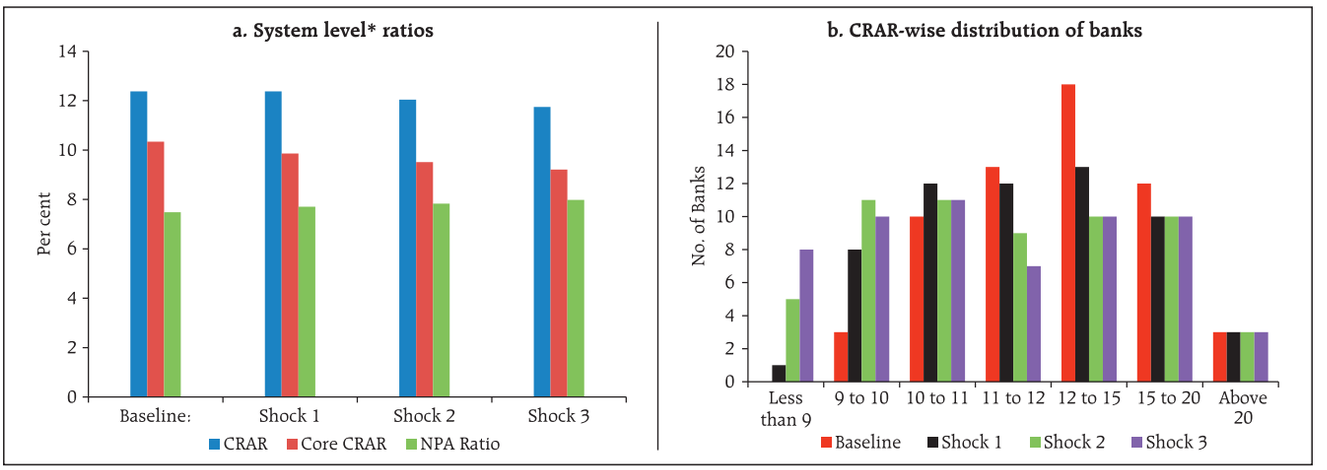
Shock 1: Top individual borrower defaults
Shock 2: Top two individual borrowers default
Shock 3: Top three individual borrowers default

Note: * System of select 60 SCBs.
Source: RBI supervisory returns and staff calculations.

[23] In case of default, the borrower is assumed to move into sub-standard category. Please see Annex 2 for details.

[24] In case of failure, the borrower is assumed to move into loss category. Please see Annex 2 for details.

Chart 2.26: Credit concentration risk: Individual borrowers – Stressed advances



Shock 1: Top stressed individual borrower defaults
Shock 2: Top two stressed individual borrowers default
Shock 3: Top three stressed individual borrowers default

Note: * System of select 60 SCBs.
Source: RBI supervisory returns and staff calculations.

scenarios of failure of the top one, two and three stressed borrowers will be 47, 81 and 110 basis points (Chart 2.26).

2.31 Stress tests using 10 different scenarios, based on the information of group borrowers on the credit concentration risk of banks reveal that the losses[25] could be around six per cent and nine per cent at the system level under the assumed scenarios of default of the top one group borrower and top two group borrowers. The losses could be 18 per cent of capital in case of default of top five group borrowers and this could be as high as 28 per cent of capital if ten top group borrowers default in severe stress conditions. As many as 25 banks will not be able to maintain their CRAR level at 9 per cent in such severe conditions (Table 2.4).

Table 2.4: Credit concentration risk: Group borrowers – Exposure

Shocks		System Level*			Bank Level		
		CRAR	Core CRAR	NPA Ratio	Losses as % of Capital	Impacted Banks (CRAR < 9%)	
Baseline (Before Shock)		12.9	10.3	7.5	---	No. of Banks	Share in Total Assets of the Banking System (in %)
Shock 1	The top 1 group borrower defaults	12.2	9.7	10.6	6	1	0.1
Shock 2	The top 2 group borrowers default	11.7	9.2	12.8	9	5	8.2
Shock 3	The top 3 group borrowers default	11.3	8.8	14.6	13	8	14.4
Shock 4	The top 4 group borrowers default	11.0	8.5	16.3	16	11	20.8
Shock 5	The top 5 group borrowers default	10.7	8.1	17.7	18	12	24.4
Shock 6	The top 6 group borrowers default	10.4	7.8	19.0	20	13	24.6
Shock 7	The top 7 group borrowers default	10.1	7.6	20.2	23	17	43.2
Shock 8	The top 8 group borrowers default	9.9	7.3	21.4	25	21	48.7
Shock 9	The top 9 group borrowers default	9.7	7.1	22.4	27	25	51.6
Shock 10	The top 10 group borrowers default	9.6	7.0	23.4	28	25	51.6

Note: * System of select 60 SCBs.
Source: RBI supervisory returns and staff calculations.

[25] In case of default, the borrower is assumed to move into sub-standard category. Please see Annex 2 for details.

Sectoral credit risk

2.32 Credit risk arising from exposure to industries was examined through a sectoral credit stress test by giving a shock to the GNPA ratio resulting in an increase in GNPAs by a fixed percentage point. The results of the sensitivity analysis revealed that the impact of assumed shocks on profitability, which is already low, would be considerable. The shocks on sub-sectors would also have significant impact on banks' profitability (PBT), while the capital impact would be limited (Table 2.5).

Table 2.5: Sectoral credit risk : Industry - shocks and impacts
(incremental shock on GNPA ratio: increase in GNPA ratio by a fixed percentage points)

(per cent)

Sector			(a) Industry				(a1) Of which: Chemical & chemical products				(a2) Of which: Textile				(a3) Of which: Basic metal & metal products (including Iron & steel)			
Sector's Profile																		
Sector's Share in Total Advances			41.68				2.31				2.98				5.90			
Sector's Share in Restructured Standard Advances			82.05				1.99				6.40				12.59			
Sector's Share in GNPAs			67.94				3.03				5.58				20.09			
Sectoral Restructured Standard Advances Ratio			7.91				3.46				8.61				8.58			
System's Restructured Standard Advances Ratio			4.02				4.02				4.02				4.02			
Shocks	**Shock on Restructured Standard Advances &**	**Shock on other Standard Advances #**	**(a) Industry**				**(a1) Of which: Chemical & chemical products**				**(a2) Of which: Textile**				**(a3) Of which: Basic metal & metal products (including Iron & steel)**			
			GNPA Ratio of the sector	**Impact at System Level***			**GNPA Ratio of the sector**	**Impact at System Level***			**GNPA Ratio of the sector**	**Impact at System Level***			**GNPA Ratio of the sector**	**Impact at System Level***		
				GNPA Ratio at system level	**Losses as per cent of Capital**	**Losses as per cent of Profit**		**GNPA Ratio at system level**	**Losses as per cent of Capital**	**Losses as per cent of Profit**		**GNPA Ratio at system level**	**Losses as per cent of Capital**	**Losses as per cent of Profit**		**GNPA Ratio at system level**	**Losses as per cent of Capital**	**Losses as per cent of Profit**
Before Shock Position			12.20	7.48	-	-	9.81	7.48	-	-	13.98	7.48	-	-	25.48	7.48	-	-
Shock-1	0	2	14.20	8.31	4.51	77.86	11.81	7.53	0.20	3.46	15.98	7.54	0.25	4.36	27.48	7.60	0.43	7.41
Shock-2		5	17.20	9.56	11.27	194.65	14.81	7.60	0.50	8.65	18.98	7.63	0.63	10.89	30.48	7.78	1.07	18.53
Shock-3		10	22.20	11.65	22.54	389.29	19.81	7.71	1.00	17.30	23.98	7.78	1.26	21.79	35.48	8.07	2.15	37.06
Shock-4	15	2	15.38	8.81	6.10	105.26	12.33	7.54	0.22	3.83	17.27	7.58	0.32	5.54	28.77	7.67	0.56	9.74
Shock-5		5	18.38	10.06	12.86	222.05	15.33	7.61	0.52	9.02	20.27	7.67	0.70	12.07	31.77	7.85	1.21	20.86
Shock-6		10	23.38	12.14	24.13	416.70	20.33	7.72	1.02	17.67	25.27	7.82	1.33	22.97	36.77	8.15	2.28	39.39
Shock-7	15	2	15.38	8.81	8.48	146.37	12.33	7.54	0.28	4.82	17.27	7.58	0.51	8.74	28.77	7.67	0.93	16.05
Shock-8		5	18.38	10.06	15.24	263.16	15.33	7.61	0.58	10.01	20.27	7.67	0.88	15.28	31.77	7.85	1.57	27.16
Shock-9		10	23.38	12.14	26.51	457.81	20.33	7.72	1.08	18.66	25.27	7.82	1.52	26.17	36.77	8.15	2.65	45.69

Note: & Assumption on asset category of new NPAs:

Shocks 1-3: No shock on restructured standard advances.

Shocks 4-6: Restructured standard advances to sub-standard category.

Shocks 7-9: Restructured standard advances to loss category.

Shock assumes increase in sectoral NPAs by a fixed percentage. The new NPAs arising out of standard advances (other than restructured standard advances) have been assumed to become sub-standard in the shock scenario.

* System of select 60 SCBs.

Source: RBI supervisory returns and staff calculations.

2.33 Sectoral credit stress tests were also conducted for the infrastructure segment, including a few important sub-sectors of power, transport and telecommunications. The tests revealed that the shocks to the infrastructure segment would considerably impact the profitability of banks, with the most significant effect of the single sector shock coming from the power and transport sectors (Table 2.6).

2.34 An analysis of a few specific industries to sectoral credit shocks was also undertaken. The analysis considered engineering, automobiles, construction and cement industries. The results of the sensitivity analysis revealed that the shocks would

Table 2.6: Sectoral credit risk : Infrastructure - shocks and impacts
(incremental shock on GNPA ratio: increase in GNPA ratio by a fixed percentage points)

(per cent)

Sector			(a) Infrastructure				(a1) Of which: Power				(a2) Of which: Transport				(a3) Of which: Telecommunication			
Sector's Profile																		
Sector's Share in Total Advances			14.22				7.82				2.87				1.50			
Sector's Share in Restructured Standard Advances			34.43				20.89				8.64				1.03			
Sector's Share in GNPAs			13.90				5.97				4.33				1.09			
Sectoral Restructured Standard Advances Ratio			9.73				10.73				12.08				4.09			
System's Restructured Standard Advances Ratio			4.02				4.02				4.02				4.02			
Shocks	**Shock on Restructured Standard Advances &**	**Shock on other Standard Advances #**	**(a) Infrastructure**				**(a1) Of which: Power**				**(a2) Of which: Transport**				**(a3) Of which: Telecommunication**			
			GNPA Ratio of the sector	**Impact at System Level***			**GNPA Ratio of the sector**	**Impact at System Level***			**GNPA Ratio of the sector**	**Impact at System Level***			**GNPA Ratio of the sector**	**Impact at System Level***		
				GNPA Ratio at system level	**Losses as per cent of Capital**	**Losses as per cent of Profit**		**GNPA Ratio at system level**	**Losses as per cent of Capital**	**Losses as per cent of Profit**		**GNPA Ratio at system level**	**Losses as per cent of Capital**	**Losses as per cent of Profit**		**GNPA Ratio at system level**	**Losses as per cent of Capital**	**Losses as per cent of Profit**
Before Shock Position			7.31	7.48	-	-	5.71	7.48	-	-	11.28	7.48	-	-	5.42	7.48	-	-
Shock-1	0	2	9.31	7.77	1.16	20.06	7.71	7.64	0.61	10.55	13.28	7.54	0.24	4.14	7.42	7.51	0.16	2.75
Shock-2		5	12.31	8.19	2.90	50.14	10.71	7.87	1.53	26.38	16.28	7.62	0.60	10.34	10.42	7.56	0.40	6.87
Shock-3		10	17.31	8.90	5.81	100.29	15.71	8.26	3.06	52.76	21.28	7.77	1.20	20.68	15.42	7.63	0.80	13.74
Shock-4	15	2	10.77	7.97	1.53	26.42	9.32	7.76	0.83	14.41	15.09	7.59	0.33	5.73	8.03	7.52	0.18	3.03
Shock-5		5	13.77	8.40	3.27	56.50	12.32	8.00	1.75	30.24	18.09	7.68	0.69	11.94	11.03	7.57	0.41	7.15
Shock-6		10	18.77	9.11	6.18	106.65	17.32	8.39	3.28	56.62	23.09	7.82	1.29	22.28	16.03	7.64	0.81	14.03
Shock-7	15	2	10.77	7.97	2.53	43.67	9.32	7.76	1.44	24.87	15.09	7.59	0.58	10.06	8.03	7.52	0.22	3.80
Shock-8		5	13.77	8.40	4.27	73.75	12.32	8.00	2.36	40.70	18.09	7.68	0.94	16.27	11.03	7.57	0.46	7.92
Shock-9		10	18.77	9.11	7.17	123.90	17.32	8.39	3.88	67.08	23.09	7.82	1.54	26.61	16.03	7.64	0.86	14.79

Note: & Assumption on asset category of new NPAs:
Shocks 1-3: No shock on restructured standard advances.
Shocks 4-6: Restructured standard advances to sub-standard category.
Shocks 7-9: Restructured standard advances to loss category.

Shock assumes increase in sectoral NPAs by a fixed percentage. The new NPAs arising out of standard advances (other than restructured standard advances) have been assumed to become sub-standard in the shock scenario.

* System of select 60 SCBs.

Source: RBI supervisory returns and staff calculations.

Table 2.7: Sectoral credit risk: Select industries
(Incremental shock on GNPA Ratio: Increase in GNPA ratio by a fixed percentage points)

(per cent)

Sector		Engineering				Automobiles				Construction				Cement			
Sector's Profile																	
Sector's Share in Total Advances		2.28				1.00				1.22				0.73			
Share of Sector in Total NPAs - Aggregate Level		3.50				1.10				2.00				1.31			
Shocks	**Shock on Standard Advances #**	**Engineering**				**Automobiles**				**Construction**				**Cement**			
		GNPA Ratio of the sector	**Impact at System Level***			**GNPA Ratio of the sector**	**Impact at System Level***			**GNPA Ratio of the sector**	**Impact at System Level***			**GNPA Ratio of the sector**	**Impact at System Level***		
			GNPA Ratio at system level	**Losses as per cent of Capital**	**Losses as per cent of Profit**		**GNPA Ratio at system level**	**Losses as per cent of Capital**	**Losses as per cent of Profit**		**GNPA Ratio at system level**	**Losses as per cent of Capital**	**Losses as per cent of Profit**		**GNPA Ratio at system level**	**Losses as per cent of Capital**	**Losses as per cent of Profit**
Before Shock Position		11.5	7.5	-	-	8.3	7.5	-	-	12.2	7.5	-	-	13.4	7.5	-	-
Shock-1	2	13.5	7.5	0.2	3.2	10.3	7.5	0.1	1.2	14.2	7.5	0.1	1.8	15.4	7.5	0.1	0.9
Shock-2	5	16.5	7.6	0.5	7.9	13.3	7.5	0.2	3.1	17.2	7.5	0.3	4.4	18.4	7.5	0.1	2.2
Shock-3	10	21.5	7.7	0.9	158	183	7.6	04	6.1	22.2	7.6	0.5	8.8	23.4	7.6	0.3	4.4

Note: # Shock assumes a fixed percentage increase in the sectoral GNPAs ratio (incremental shock on GNPA ratio- addition on existing GNPA ratio). The new GNPAs arising out of standard advances have been assumed to be distributed among different asset classes (following the existing pattern) in the shock scenario.
*System of select 60 SCBs.
Source: RBI supervisory returns and staff calculations.

impact the profitability, with the most significant effect of the single industry shock coming from engineering (Table 2.7).

Interest rate risk

2.35 The interest rate risk arising from a parallel upward shift of 2.5 percentage points in the yield curve of securities under available for sale (AFS) and held for trading (HFT) portfolios of banks (direct impact) appears manageable as the impact on CRAR will be about 97 basis points at the system level. Table 2.8 shows the bank group level analysis. At the disaggregated level, six banks accounting for 11.6 per cent of the total assets were impacted adversely and their CRAR fell below 9 per cent. The total capital loss at the system level was estimated to be about 8.6 per cent. The assumed shock of a 2.5 percentage points parallel upward shift of the yield curve on the held to maturity (HTM) portfolios of banks, if marked-to-market, markedly reduces CRAR by about 227 basis points adversely impacting 20 banks, whose CRAR fell below 9 per cent. The income impact on SCBs' banking books[26] could be about 45 per cent of their latest annual PBT under the assumed shock of a parallel downward shift (2.5 percentage points) in the yield curve.

Table 2.8: Interest rate risk – bank groups - shocks and impacts
(under shock of 250 basis points parallel upward shift of the INR yield curve)

(per cent)

	PSBs		PVBs		FBs	
	AFS	**HFT**	**AFS**	**HFT**	**AFS**	**HFT**
Modified duration	4.2	4.7	2.4	3.9	1.2	2.0
Share in total investments	35.4	0.6	35.1	5.1	81.0	18.5
Reduction in CRAR (bps)	123		43		105	

Source: RBI supervisory returns and staff calculations.

[26] The income impact on banking books, considering the exposure gap of rate sensitive assets and liabilities, excluding AFS and HFT portfolios, is calculated for one year only.

Liquidity risk

2.36 Statutory liquidity ratio (SLR) investments, in general, will help the banks to withstand sudden liquidity shocks. The liquidity risk analysis captures the impact of assumed scenarios on banks where deposit run-offs as well as increased demand for the unutilised portion of credit lines which were sanctioned/committed (taking into account the undrawn working capital limit and undrawn committed lines of credit) were considered. In assumed scenarios, there will be increased withdrawals of un-insured deposits[27] and simultaneously there will also be increased demand for credit resulting in withdrawal of the unutilised portions of sanctioned working capital limits as well as credit commitments of banks towards their customers. It is presumed that banks will be required to meet these using their stocks of liquid assets (full or a portion of the SLR portfolio) only, with no external funding factored in. A 10 per cent haircut/ margin was assumed on the investments. The tests[28] were conducted for SCBs using two approaches based on March 2016 data.

2.37 In the first case, it was assumed that full SLR investments and the excess cash reserve ratio (CRR) will be available to banks to support their liquidity requirements in the stress scenario, which may be through specific policy measures taken during a crisis.

2.38 The analysis shows that though there will be liquidity pressure under the stress scenarios, most banks (49 out of the 60 banks in the sample) can withstand sudden and unexpected withdrawals of around 25 per cent of deposits along with the utilisation of 75 per cent of their committed credit lines with the help of their SLR investments (Table 2.9).

2.39 The second case considers liquidity coverage ratio[30] (LCR) regime where readily available high quality liquid assets[31] (HQLAs) will help banks withstand the initial shocks.

2.40 Under the LCR regime, most banks (44 out of the 60 banks in the sample) will remain resilient in a scenario of assumed sudden and unexpected withdrawals of around 10 per cent of deposits along with the utilisation of 75 per cent of their committed credit lines with the help of their available HQLAs

Table 2.9: Liquidity risk – Shocks and impacts
(using full SLR along with excess CRR for liquidity support)

Shocks		Liquid assets Available to the system (per cent of total assets)	Number of banks which failed[29] the test (out of select 60)	Share of assets of failed banks in stress scenario to total assets of SCBs (per cent)
Shocks	Cumulative (un-insured) deposits withdrawal (per cent)			
Baseline	-	20.9	-	-
Shock 1	10	12.4	1	0.6
Shock 2	20	6.7	4	1.5
Shock 3	25	3.7	11	12.1
Shock 4	30	1.6	30	46.4

Source: RBI supervisory returns and staff calculations.

[27] Presently un-insured deposits are about 69 per cent of total deposits (Source: DICGC, *Handbook of Statistics on Indian Economy*).

[28] Liquidity shocks include withdrawal of a portion of un-insured deposits and also a demand for 75 per cent of the committed credit lines (comprising unutilised portions of sanctioned working capital limits as well as credit commitments towards their customers).

[29] A bank failed the test when it was unable to meet the requirements under the stress scenarios (on imparting shocks) with the help of its liquid assets (stock of liquid assets turned negative under the stress conditions).

[30] Guidelines on the Basel III Framework on Liquidity Standardon - LCR, liquidity risk monitoring tools and LCR disclosure standards were issued vide circular DBOD.BP.BC 120/21.04.098/2013-14 dated June 9, 2014.LCR is being introduced in a phased manner starting with a minimum requirement of 60 per cent from January 1, 2015 and reaching minimum 100 per cent on January 1, 2019.

[31] For the stress testing exercise, HQLAs were computed as cash reserves in excess of required CRR, excess SLR investments,SLR investments at 2 per cent of NDTL (under MSF) and additional SLR investments at 8 per cent of NDTL (following the circular DBR.BP.BC 52/21.04.098/2014-15 dated November 28, 2014 and DBR.BP.BC.No. 77/21.04.098/2015-16 dated February 11, 2016).

(recognised under LCR) (Table 2.10). In case of incremental shocks in an extreme crisis, banks will be able to withstand further withdrawal of deposits using their remaining SLR investments as discussed in para 2.38 (Table 2.9) through specific policy measures taken as per requirements.

Table 2.10: Liquidity risk – Shocks and impacts – LCR regime
(using HQLAs for liquidity support)

Shocks		Liquid assets available to the system (per cent of total assets)	Number of banks which failed the test (Out of select 60)	Share of assets of failed banks in stress scenario to total assets of SCBs (per cent)
Shocks	Cumulative (un-insured) deposit withdrawal (per cent)			
Baseline	-	11.4	-	-
Shock 1	5	5.1	3	1.2
Shock 2	7	4.0	6	4.5
Shock 3	10	2.5	16	29.6
Shock 4	12	1.7	25	41.8

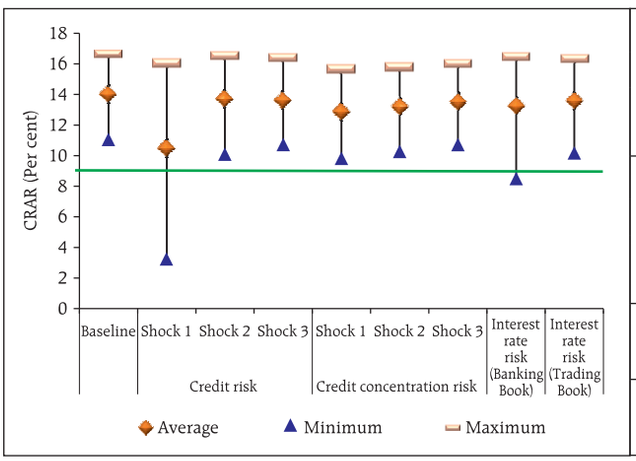
Source: RBI supervisory returns and staff calculations.

Bottom-up stress tests

2.41 A series of bottom-up stress tests (sensitivity analyses) were conducted for the select sample banks,[32] with the reference date as March 31, 2016. The results of the bottom-up stress tests carried out by select banks also testified to the banks' general resilience to different kinds of shocks. While confirming the top-down stress tests results in general, the bottom-up stress tests also pointed out that most banks could withstand the impact of the shocks, though the impact was relatively more severe on some banks, especially in case of shocks imparted on NPAs, with their stressed CRAR positions falling below the regulatory minimum of 9 per cent (Chart 2.27).

2.42 The results of bottom-up stress tests for liquidity risk show a significant impact of liquidity shocks on select banks. Liquid assets ratios[33] using various definitions reflect the liquidity position of (select) banks under different scenarios. The results show that SLR investments and CRR deposits helped banks sustain themselves against the liquidity

Chart 2.27: Bottom-up stress tests – Credit and market risks – Impact on CRAR



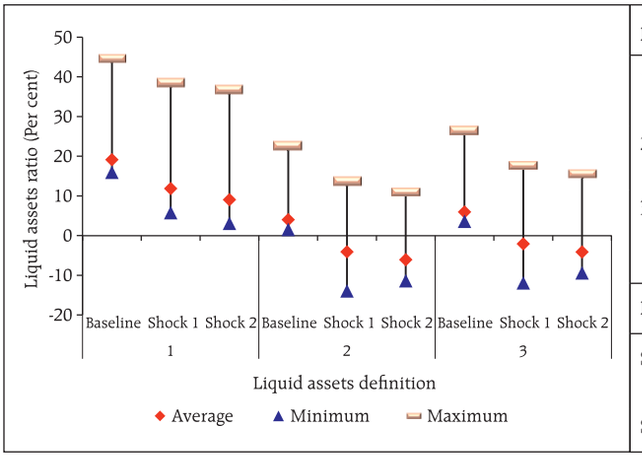
Credit Risk: Gross Credit	Shock1	NPAs increase by 100 per cent
	Shock2	30 per cent of restructured assets become NPAs
	Shock3	5 percentage points increase in NPAs in each top 5 sector / industry
Credit Risk: Concentration	Shock1	The top three individual borrowers default
	Shock2	The top largest group defaults
	Shock3	The largest borrower of each of top five industries/ sectors defaults
Interest Rate Risk – Banking Book	Shock	Parallel upward shift in INR yield curve by 2.5 percentage points
Interest Rate Risk – Trading Book	Shock	Parallel upward shift in INR yield curve by 2.5 percentage points

Source: Select banks (Bottom-up stress tests).

[32] Stress tests on various shocks were conducted on a sample of 15 select banks. The same set of shocks was used for conducting top-down and bottom-up stress tests. Details of these are given in Annex 2.

[33] Liquid Assets Ratio $= \frac{Liquid\ Assets}{Total\ Assests} \times 100$. Under shock scenarios, the negative liquid assets ratio reflects the percentage deficit in meeting the required deposit withdrawal.

Chart 2.28: Bottom-up stress tests – Liquidity risk



Liquid Assets Definitions	
1	Cash + Excess CRR + Interbank deposits maturing-within-1-month + SLR investments.
2	Cash + Excess CRR + Interbank deposits maturing-within-1-month + Excess SLR investments.
3	Cash + Excess CRR + Interbank deposits maturing-within-1-month + Excess SLR investments + other investments which the bank consider liquid.
Liquidity Shocks	
Shock1	10 per cent deposits withdrawal (cumulative) during a short period (say 1 or 2 days).
Shock2	3 per cent deposits withdrawal (each day) within 5 days.

Note: The liquid asset ratios for some banks dipped into a negative zone under conservative liquid assets definitions 2 & 3.
Source: Select banks (Bottom-up stress tests).

pressure from sudden and unexpected withdrawal of deposits by depositors (Chart 2.28).

Stress testing the derivatives portfolio of banks

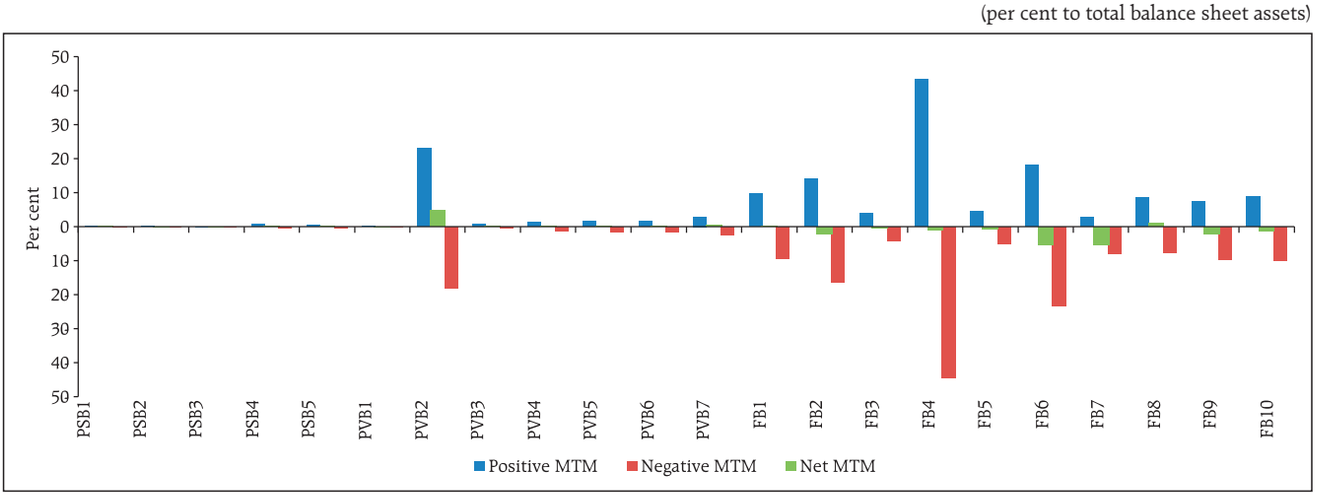
2.43 A series of bottom-up stress tests (sensitivity analyses) on derivatives portfolio were conducted for select sample banks[34] with the reference date as on March 31, 2016. The shocks on interest rates ranged from 100 to 250 basis points, while 20 per cent appreciation/depreciation shocks were assumed for foreign exchange rates. The stress tests were carried out for individual shocks on a stand-alone basis.

2.44 In the sample, the marked-to-market (MTM) impact has been varied with FBs accounting for the major impact (Chart 2.29).

2.45 The stress test results showed that the average net impact of interest rate shocks on sample banks were negligible. The foreign exchange shock scenarios

Chart 2.29: MTM of total derivatives portfolio - Select banks - March 2016

(per cent to total balance sheet assets)

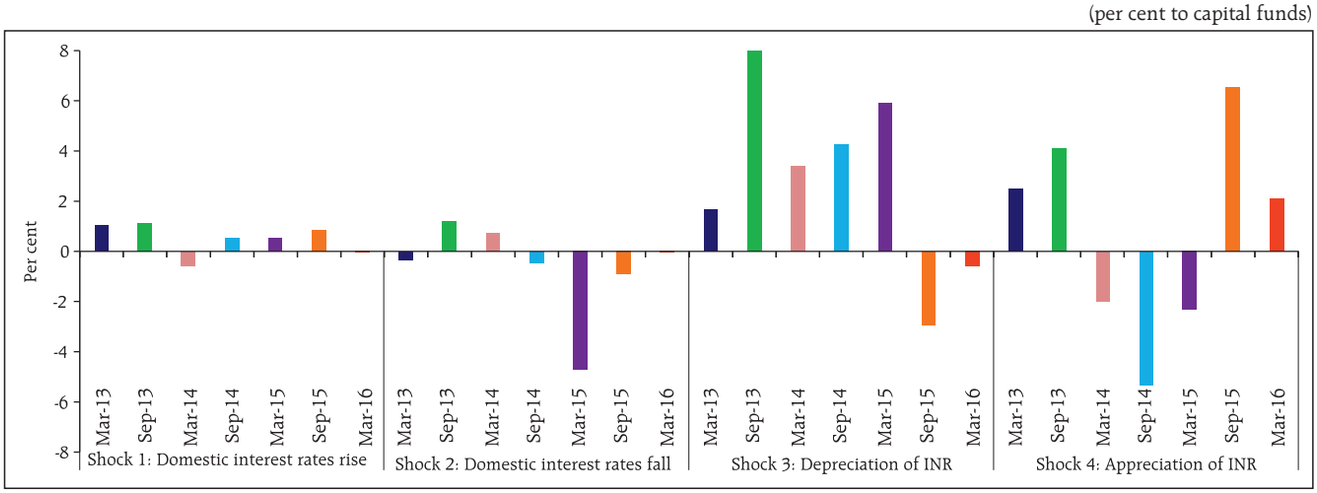


Note: PSB: Public sector bank, PVB: Private sector bank, FB: Foreign bank.
Source: Sample banks (Bottom-up stress tests on derivatives portfolio).

[34] Stress tests on derivatives portfolio were conducted for a sample of 22 banks. Details are given in Annex 2.

Chart 2.30: Stress tests - Impact of shocks on derivatives portfolio of select banks (change in net MTM on application of a shock)

(per cent to capital funds)



Note: Change in net MTM due to an applied shock with respect to the baseline.

Source: Sample banks (Bottom-up stress tests on derivatives portfolio).

also showed a relatively lower impact in March 2016 (Chart 2.30).

Section II

Scheduled urban co-operative banks

Performance

2.46 At the system level,[35] CRAR of scheduled urban co-operative banks (SUCBs) rose from 12.7 per cent to 13.0 per cent between September 2015 and March 2016. However, at a disaggregated level, six banks failed to maintain the minimum required CRAR of 9 per cent. GNPAs of SUCBs as a percentage of gross advances declined considerably to 6.4 per cent from 7.7 per cent and their provision coverage ratio[36] increased to 56.6 per cent from 50.9 per cent during the same period. Further, RoA declined from 0.8 per cent to 0.6 per cent and the liquidity ratio[37] fell marginally from 35.0 per cent to 34.8 per cent during the same period.

Resilience - Stress tests

Credit risk

2.47 A stress test for assessing credit risk was carried out for SUCBs using data as of March 31, 2016. The impact of credit risk shocks on the CRAR of SUCBs was observed under four different scenarios.[38] The results showed that except under the extreme scenario (two SD increase in GNPAs which are classified as loss advances), the system level CRAR of SUCBs remained above the minimum regulatory required level. However, individually, a large number of banks (30 out of 52 banks) will not be able to meet the required CRAR levels under the extreme scenario.

Liquidity risk

2.48 A stress test on liquidity risk was carried out using two different scenarios; i) 50 per cent and ii) 100 per cent increase in cash outflows, in the one to 28 days' time bucket. It was further assumed that there was no change in cash inflows under both the scenarios. The stress test results indicate that SUCBs will be significantly impacted under a stress scenario (out of 52 banks, 25 banks under Scenario i and 38 banks under Scenario ii) and will face liquidity stress.

[35] System of 52 SUCBs.

[36] Provision coverage ratio =Provisions held for NPA*100/GNPAs.

[37] Liquidity ratio = (Cash + Due from banks + SLR investment)*100 / total assets.

[38] The four scenarios are: i) 1 SD shock in GNPA (classified into sub-standard advances), ii) 2 SD shock in GNPA (classified into sub-standard advances), iii) 1 SD shock in GNPA (classified into loss advances), and iv) 2 SD shock in GNPA (classified into loss advances). The SD was estimated using 10 years data. For details of the stress tests, see Annex 2.

Section III

Non-banking financial companies

2.49 As of March 31, 2016, there were 11,682 non-banking financial companies (NBFCs) registered with the Reserve Bank, of which 202 were deposit-accepting (NBFCs-D) and 11,480 were non-deposit accepting NBFCs (NBFCs-ND). There were 220 systemically important non-deposit accepting NBFCs (NBFCs-ND-SI)[39]. All NBFCs-D and NBFCs-ND-SI are subject to prudential regulations such as capital adequacy requirements and provisioning norms along with reporting requirements.

Performance

2.50 The aggregated balance sheet of the NBFC sector expanded by 15.5 per cent on a y-o-y basis in March 2016 as compared to 15.7 per cent in the previous year. Loans and advances increased by 16.6 per cent, while, total borrowings increased by 15.3 per cent in March 2016 (Table 2.11).

2.51 The financial performance of NBFC sector has remained unchanged for the last two years. Net profit as a percentage to total income remained at 18.3 per cent between March 2015 and March 2016 and RoA stood at 2.2 per cent during the same period. RoE increased to 10.6 per cent from 10.3 per cent (Table 2.12). While the regulatory norms for the NBFC sector are sought to be brought closer to those applicable to SCBs, the performance of this sector (RoE and RoA) seems to be much better as compared to that of banks.

Asset quality and capital adequacy

2.52 GNPAs of the NBFC sector as a percentage of total advances declined to 4.6 per cent in March 2016 from 5.1 per cent in September 2015. NNPAs as a percentage of total advances also declined to 2.5 per cent from 2.9 per cent during the same period (Chart 2.31).

Table 2.11: Consolidated balance sheet of the NBFC sector: y-o-y growth

(per cent)

Item	Mar-15	Mar-16
1. Share capital	6.3	4.8
2. Reserves and surplus	13.5	14.3
3. Total borrowings	16.9	15.3
4. Current liabilities and provisions	14.1	31.8
Total Liabilities / Assets	**15.7**	**15.5**
1. Loans & advances	17.1	16.6
2. Investments	11.5	10.8
3. Other assets	10.6	12.7
Income/Expenditure		
1.Total income	15.3	15.8
2. Total expenditure	15.5	15.8
3. Net profit	15.0	15.6

Source: RBI supervisory returns.

Table 2.12: Financial performance of the NBFC sector

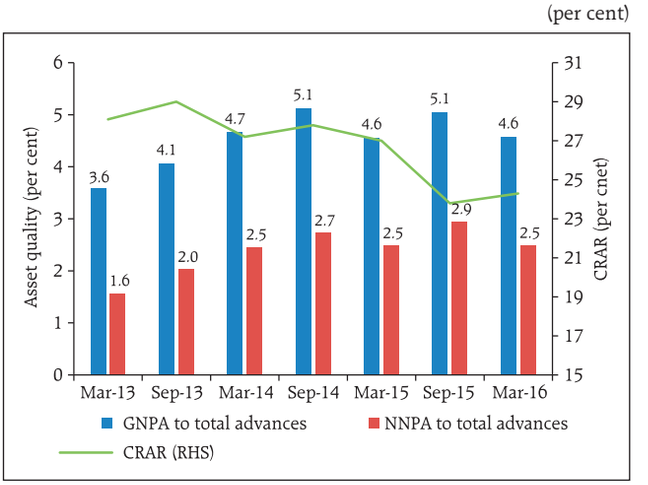
(per cent)

Item	Mar-15	Mar-16
1. Capital market exposure(CME) to total assets	7.4	8.5
2. Leverage ratio	3.7	3.9
3. Net profit to total income	18.3	18.3
4. RoA	2.2	2.2
5. RoE	10.3	10.6

Source: RBI supervisory returns.

Chart 2.31: Asset quality and capital adequacy of the NBFC sector

(per cent)



Source: RBI supervisory returns

[39] NBFCs-ND-SIs are NBFCs-ND with assets of ₹5 billion and above.

2.53 As per extant guidelines, NBFCs[40] are required to maintain a minimum capital consisting of Tier-I[41] and Tier-II capital, of not less than 15 per cent of their aggregate risk-weighted assets. The CRAR of NBFCs increased to 24.3 per cent as of March 2016 from 23.8 per cent as of September 2015 (Chart 2.31). At the disaggregated level, seven NBFCs were unable to meet the regulatory required minimum CRAR of 15 per cent as of March 2016.

Resilience - Stress tests

System level

2.54 Stress test on credit risk for the NBFC sector as a whole for the period ended March 2016 was carried out under three scenarios: (i) GNPA increase by 0.5 SD, (ii) GNPA increase by 1 SD and (iii) GNPA increase by 3 SD. The results indicate that in the first and second scenarios, the CRAR of the sector was marginally affected while in the third scenario, it declined to 23.3 per cent from 24.3 per cent. This however, was much above the regulatory minimum required level of 15 per cent.

Individual NBFCs

2.55 Stress test on credit risk for individual NBFCs was also conducted for the same period under the same three scenarios. The results indicate that under scenarios (i) and (ii), around 5 per cent of the companies, will not be able to comply with the minimum regulatory capital requirements, while 8 per cent of the companies will not be able to comply under the third scenario.

Section IV

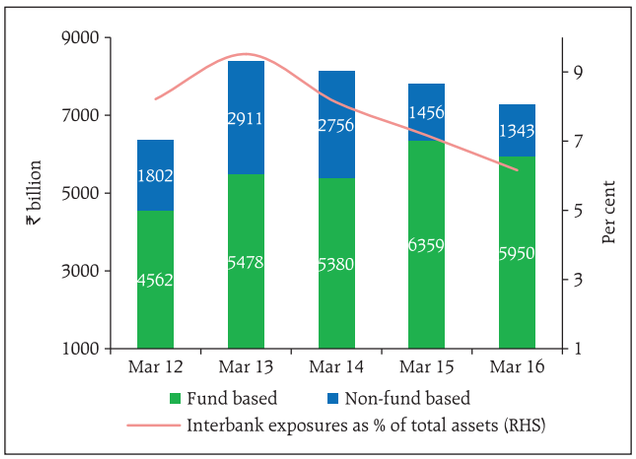
Interconnectedness[42]

Trends in the interbank market[43]

2.56 The interbank market continued to display a declining trend with a turnover of ₹7.2 trillion in March 2016, a shrinkage of over 6 per cent over March 2015. Fund based exposure in the interbank market displayed an increasing trend over the last three years, with a share of nearly 82 per cent in March 2016[44] (Chart 2.32).

2.57 While the PSBs remained the most dominant participants in the market, the share of PVBs indicated a steady increase over the last two years. The share of all the banks in the interbank market was, however, widely distributed as indicated by the Herfindahl-

Chart 2.32: Size (turnover) of the interbank market



Source: RBI supervisory returns

[40] Deposit accepting NBFCs and non-deposit accepting NBFCs having asset size of ₹ 5 billion and above.

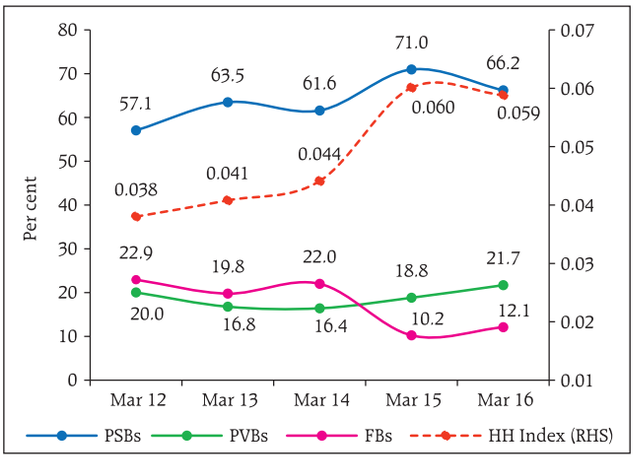
[41] As per the revised guidelines issued on November 10, 2014, minimum Tier-I capital for NBFCs-ND-SI (having asset size of ₹5 billion and above) and all deposit accepting NBFCs was revised to 10 per cent (earlier Tier-I capital could not be less than 7.5 per cent) and these entities have to meet compliance in a phased manner: 8.5 per cent by end-March 2016 and 10 per cent by end-March 2017.

[42] The network model used in the analysis has been developed by Professor Sheri Markose (University of Essex) and Dr. Simone Giansante (Bath University) in collaboration with the Financial Stability Unit, Reserve Bank of India.

[43] Banks, besides transacting among themselves over the call, notice and other short-term markets, also invest in each other's long-term instruments and take positions through derivatives and other non-fund based exposures. The interbank market as connoted in the current analysis is a total of all outstanding exposures, short-term, long-term, fund and non-fund based, between banks.

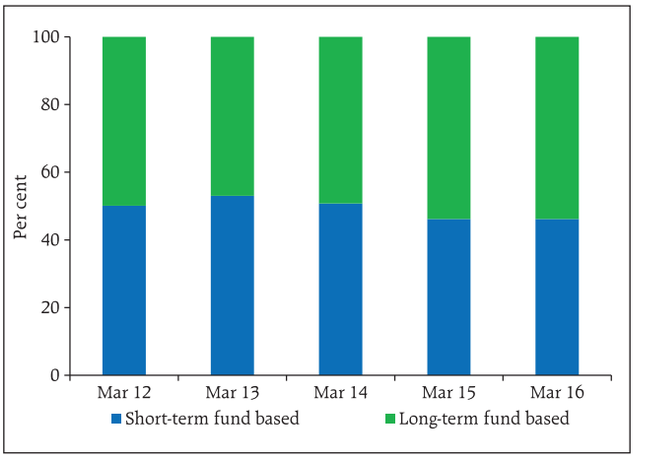
[44] Network analysis considers bilateral exposures between institutions. With respect to derivative transactions, deals which are centrally cleared or guaranteed by a central counter party (CCP) have not been considered in the current analysis. As a substantial portion of nun-fund based exposures like forex forwards etc. are now largely standardised and are cleared by a CCP, they have not been taken up in this analysis. This explains a gradual decline in the size of the non-fund based interbank market.

Chart 2.33: Share of different bank groups in the interbank market



Source: RBI supervisory returns

Chart 2.34: Share of long-term and short-term exposures in the fund based interbank market



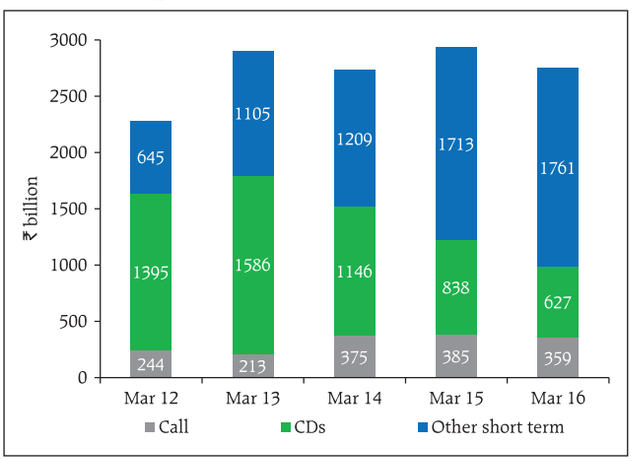
Source: RBI supervisory returns

Hirschman Index (HH Index) of around 0.06 in March 2016 (Chart 2.33).

2.58 The interbank market is generally perceived to be a source of funding liquidity. In the Indian context, however, the share of long-term bilateral exposures between banks has been steadily increasing over the years. Around 54 per cent of the exposure in the fund-based interbank market was long-term in nature as of March 2016 (Chart 2.34).

2.59 While there was not much change in the size of the overall short-term fund-based interbank market, a visible trend was the sharp decline in the share of certificate of deposits (CDs). The share of call money and CDs which together accounted for over 71 per cent of the short-term interbank market in March 2012, declined to around 36 per cent in March 2016. During the same period, the share of other short-term interbank exposure increased from 28 per cent to 64 per cent (Chart 2.35).

Chart 2.35: Composition of short-term fund based interbank market



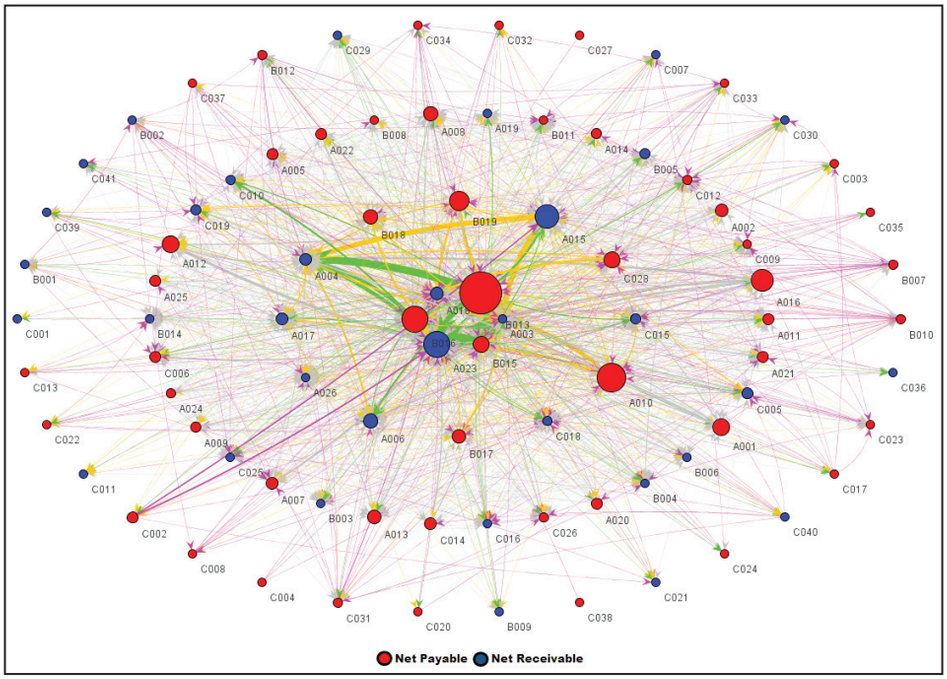
Note: Other short-term includes short-term deposits, short-term lending, *etc.*
Source: RBI supervisory returns.

Network structure and connectivity

2.60 The network structure[45] of the banking system has consistently remained tiered, with the same set

[45] The diagrammatic representation of the network of the banking system is that of a tiered structure, where different banks have different degrees or levels of connectivity with others in the network. In the present analysis, the most connected banks are in the inner most core (at the centre of the network diagram). Banks are then placed in the mid core, outer core and the periphery (the respective concentric circles around the centre in the diagram), based on their level of relative connectivity. The colour coding of the links in the tiered network diagram represents borrowings from different tiers in the network (for example, the green links represent borrowings from the banks in the inner core). Each ball represents a bank and they are weighted according to their net positions vis-à-vis all other banks in the system. The lines linking each bank are weighted on the basis of outstanding exposures.

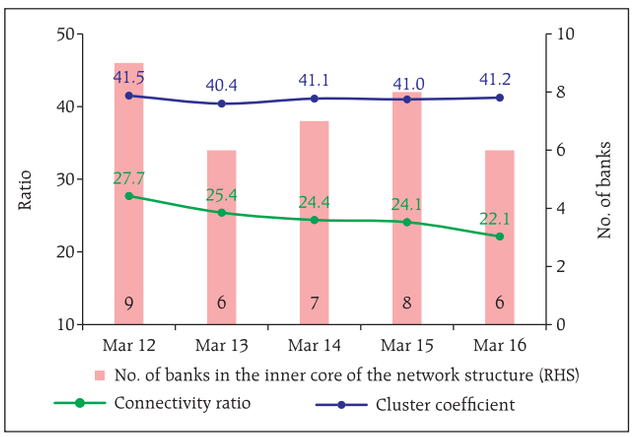
Chart 2.36: Network structure of the Indian banking system – March 2016



Source: RBI supervisory returns and staff calculations.

of banks continuing to dominate (Chart 2.36). The degree of interconnectedness in the banking system can be measured by the connectivity ratio[46] which has shown a declining trend indicating that the links/ connections between the banks have reduced. The dominant banks are depicted in the inner most circle of the network plot. The number of such banks ranged between nine and six during March 2012 to March 2016. The cluster coefficient[47], which depicts local interconnectedness remained consistent during the period from March 2012 to March 2016 indicating that the clustering/ grouping within the banking network has not changed much over time (Chart 2.37).

Chart 2.37: Connectivity statistics of the banking system



Source: RBI supervisory returns and staff calculations.

Network of the financial system

2.61 From the perspective of the larger financial system, the flow of funds between the SCBs, asset management companies managing mutual funds (AMC-MFs), insurance companies, NBFCs, urban co-

[46] *Connectivity ratio:* This is a statistic that measures the extent of links between the nodes relative to all possible links in a complete graph.

[47] *Cluster coefficient:* Clustering in networks measures how interconnected each node is. Specifically, there could be an increased probability that two of a node's neighbours (banks' counterparties in case of the financial network) are also neighbours themselves. A high cluster coefficient for the network corresponds to high local interconnectedness prevailing in the system.

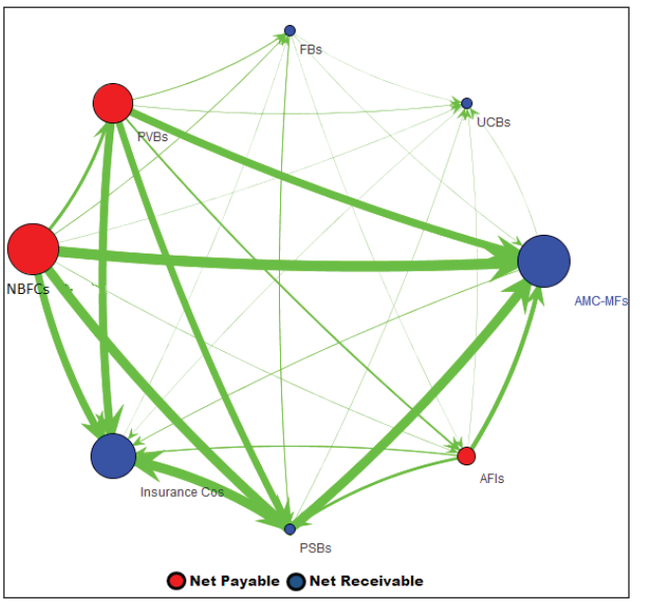
operative banks (UCBs) and other all India financial institutions (AFIs) assume importance. The AMC-MFs followed by insurance companies are the biggest fund providers in the system, while SCBs followed by NBFCs are the biggest receiver of funds. Within SCBs, however, both PSBs and FBs have a net receivable position vis-à-vis the entire financial sector, whereas PVBs have a net payable position. Further, the four AFIs included in the analysis are significant participants in the financial system (Chart 2.38 and Table 2.13).

Interaction between SCBs, AMC-MFs and insurance companies

2.62 Other than SCBs, the two most dominant sectors in the Indian financial system are the insurance companies and AMC-MFs. These three sectors taken together account for more than 80 per cent of the financial system. As at end March 2016, the exposure[52] of AMC-MFs towards the financial system was around 36 per cent of its total assets under management (AUM), while the exposure of the banking system and insurance sector to the financial system was around 15 and 10 per cent of their total assets, respectively[53].

2.63 The banking sector had a combined exposure of over ₹176 billion towards the insurance and mutual fund sector, which accounted for 0.2 per cent of the total assets of the banking system[54] in March 2016. At the same time, the combined exposure of AMC-MFs and insurance companies towards the banking sector was nearly ₹4.9 trillion which was around 19 per cent and 10 per cent of their respective AUMs. While the exposure of AMC-MFs to banks was primarily through short-term instruments (₹1.4 trillion), the insurance

Chart 2.38: Network plot of the financial system



Source: RBI supervisory returns and staff calculations.

Table 2.13: Inter-sector assets and liabilities

(₹ billion)

	Receivables	Payables
SCBs	3585	6494
AMC-MFs[48]	4508	265
Insurance Companies[49]	3709	117
NBFCs[50]	393	4615
UCBs[51]	123	22
All India FIs (NABARD, Exim Bank, NHB, SIDBI)	1309	2114

Note: The receivable and payable amount does not include transactions done among entities which are part of the same group.
Source: RBI supervisory returns and staff calculations.

[48] The sample includes 22 AMC-MFs which cover more than 90 per cent of the AUMs of the mutual fund sector.

[49] The sample includes 21 insurance companies which cover more than 90 per cent of the assets of insurance companies.

[50] This is a representative sample of the NBFC sector and includes 34 companies (both deposit taking and non-deposit taking systemically important companies).

[51] The sample includes 20 SUCBs.

[52] The exposure of AMC-MFs, SCBs and insurance companies to the financial system also includes exposure to entities within the same group.

[53] Data on total assets of insurance companies as at end March 2016 is still not available. Data pertaining to December 2015 has been used in this respect.

[54] Only on-balance sheet assets from domestic operations have been considered.

companies had substantial exposure through long-term instruments (₹2.2 trillion) (Table 2.14).

SCBs, AMC-MFs and insurance companies' interaction with NBFCs

2.64 While SCBs were the largest gross receivers of funds from the rest of the financial system, NBFCs continued to be the largest net receivers of funds from the rest of the system. As of March 2016, the banking sector had an outstanding exposure of over ₹2 trillion to NBFCs. Further, the exposure of AMC-MFs to NBFCs displayed an increasing trend between March 2012 and March 2016 (Table 2.15).

Contagion analysis

2.65 A contagion analysis using network tools is a stress test which is carried out to estimate potential loss that could happen in the event of failure of one or more banks. Further, the extent of loss that could be triggered by a bank is also an indicator of its systemic importance. While a contagion could be triggered by the failure of any bank, the current analysis was conducted with the top net borrowers and net lenders as trigger banks. Theoretically, a net borrower bank will generate a solvency contagion while a net lender bank will generate a liquidity contagion. However, in reality, both solvency and liquidity contagions are likely to occur simultaneously as typically a bank is a net borrower vis-à-vis some counterparties while remaining a net lender for some others. An analysis was undertaken to assess the impact of failure of the top borrower and top lender of the banking system on the Tier-I capital of the system (Tables 2.16 and 2.17). The failure of the top net borrower bank could result in a loss of nearly 37 per cent of Tier-I capital of the banking system (under the joint solvency liquidity contagion) while the failure of the top net lender bank could result in a loss of nearly 38 per cent of Tier-I capital, subject to certain assumptions made with regard to contagion.[55] It may be observed that failure of Bank D, the fourth

Table 2.14: Pattern of AMC-MFs' and insurance companies' exposure to banks (March 2016)

(₹ billion)

	AMC-MFs			Insurance companies		
	Investment in short-term instruments	Investment in capital instruments	Investment in bonds and other long-term instruments	Investment in short-term instruments	Investment in capital instruments	Investment in bonds and other long-term instruments
PSBs	1058	140	153	139	455	723
PVBs	357	550	137	45	508	551
FBs	25	0	9	2	0	0
All SCBs	1439	690	300	186	963	1275

Source: RBI supervisory returns

Table 2.15: Exposure of SCBs, AMC-MFs and insurance companies to NBFCs

(₹ billion)

	Mar-12	Mar-13	Mar-14	Mar-15	Mar-16
SCBs	1513	1453	1516	1595	2029
AMC-MFs	425	624	756	1008	1489
Insurance companies	780	880	965	1080	1038

Source: RBI supervisory returns.

Table 2.16: Contagion triggered by net borrower banks
(percentage loss of total Tier I capital of the banking system)

Top Net Borrower Banks	Solvency Contagion	Liquidity Contagion	Joint Solvency Liquidity Contagion
Bank A	6.8	1.0	36.8
Bank B	3.8	0.5	4.1
Bank C	2.6	0.2	2.8
Bank D	3.8	8.8	40.3
Bank E	2.0	0.1	2.0

Source: RBI supervisory returns and staff calculations.

Table 2.17: Contagion triggered by net lender banks
(percentage loss of total Tier I capital of the banking system)

Top Net Lender Banks	Solvency Contagion	Liquidity Contagion	Joint Solvency Liquidity Contagion
Bank 1	0.1	20.4	37.5
Bank 2	0.7	17.0	38.8
Bank 3	4.0	7.7	42.4
Bank 4	0.8	3.3	2.7
Bank 5	0.7	12.6	38.5

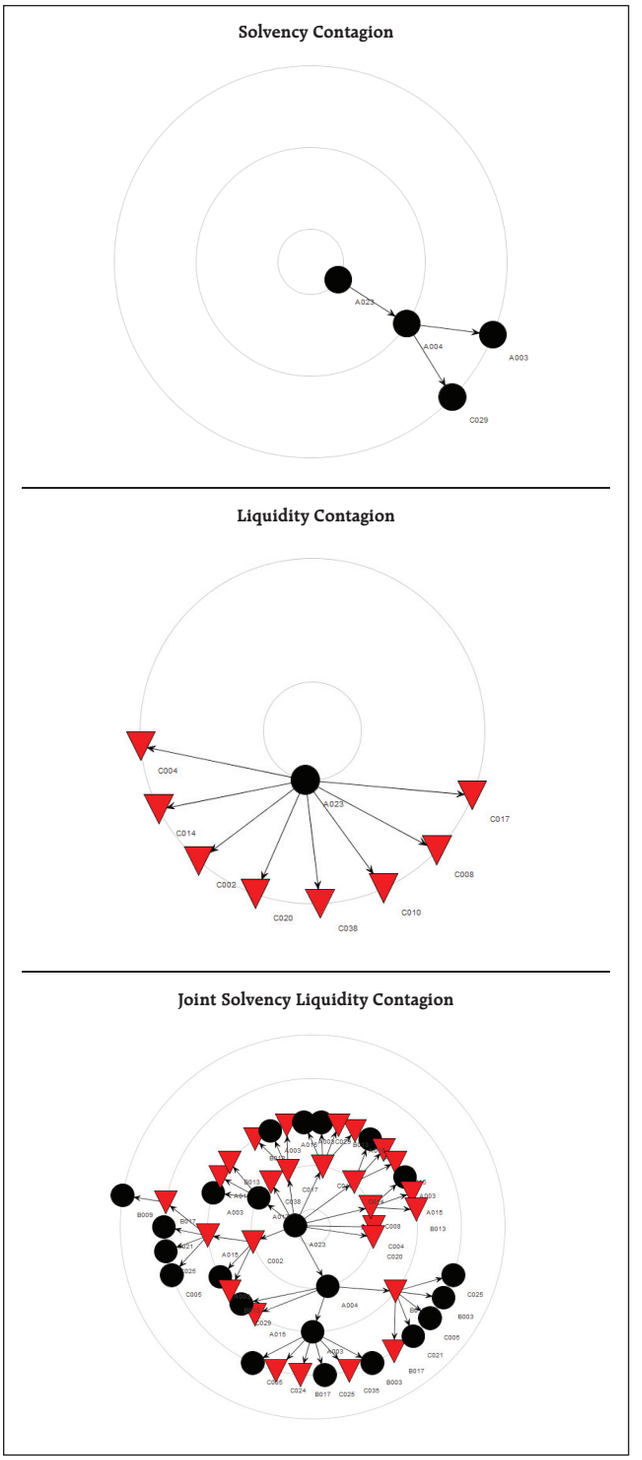
Source: RBI supervisory returns and staff calculations.

[55] Please see Annex 2 for methodology.

among the net borrower banks, resulted in a more severe loss than the failure of the top net borrower bank due to the greater connectivity of this bank.

2.66 More banks fail in case of a joint contagion since the spread of the contagion is via both the asset and liability sides of banks while in the case of a standalone contagion the spread is one-sided [that is either asset or liability side] and hence the impact of a joint contagion is generally found to be severe and often disproportionate vis-à-vis a standalone contagion (Chart 2.39).

Chart 2.39: Impacted banks for the same trigger bank



Note: The single black circle in the innermost ring is the trigger bank while the other black circles and red triangles on the outer rings depict the impacted banks (black in case of failure under solvency contagion and red in case of failure under liquidity contagion), with each outer ring representing one round of contagion and the arrow heads pointing the direction of impact.
Source: RBI supervisory returns and staff calculations.