Chapter II

Financial Institutions: Soundness and Resilience

During 2016-17, while deposit growth of scheduled commercial banks (SCBs) picked up, credit growth remained sluggish putting pressure on net interest income (NII), particularly of the public sector banks (PSBs). While profitability ratios of SCBs showed a marginal increase, PSBs as a group continue to show a negative return on assets (RoA). The gross non-performing advances (GNPAs) of the banking sector rose but the stressed advances ratio declined between September 2016 and March 2017. Overall, capital to risk-weighted assets ratio (CRAR) improved from 13.4 per cent to 13.6 per cent between September 2016 and March 2017 owing to improvement in capital adequacy of private and foreign banks.

The macro stress test indicates that under the baseline scenario, GNPAs of SCBs may rise from 9.6 per cent in March 2017 to 10.2 per cent by March 2018.

The banking stability indicator (BSI) worsened between September 2016 and March 2017 due to deterioration in asset quality and profitability.

Section I

Scheduled commercial banks[1]

2.1   In this section, the soundness and resilience of scheduled commercial banks (SCBs)[2] is discussed under two broad sub-heads: i) performance and ii) resilience using macro-stress tests through scenarios and single factor sensitivity analyses.

Performance

2.2   SCBs' credit growth declined on y-o-y basis, across the bank-groups, whereas, deposit growth increased between September 2016 and March 2017. SCBs' capital to risk-weighted assets ratio (CRAR) improved from 13.4 per cent to 13.6 per cent between September 2016 and March 2017. However,

the Tier-I leverage ratio[3] at the system level declined marginally during the same period (Chart 2.1).

2.3   SCBs' annual profit after tax (PAT) expanded by 48.0 per cent in 2016-17 as against a decline of 61.6 per cent in 2015-16, mainly due to higher increase in other operating income (OOI) and lower rise in risk provisions. However, public sector banks (PSBs) once again recorded negative returns on their assets. The share of OOI in total operating income increased sharply from 30.7 per cent in 2015-16 to 36.2 per cent in 2016-17, mostly contributed by profit on securities trading. Continuing deceleration in the growth of assets of SCBs along with deterioration in their asset quality resulted in a secular decline in the share of net interest income (NII) in total operating income (Chart 2.1).

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

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

[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.

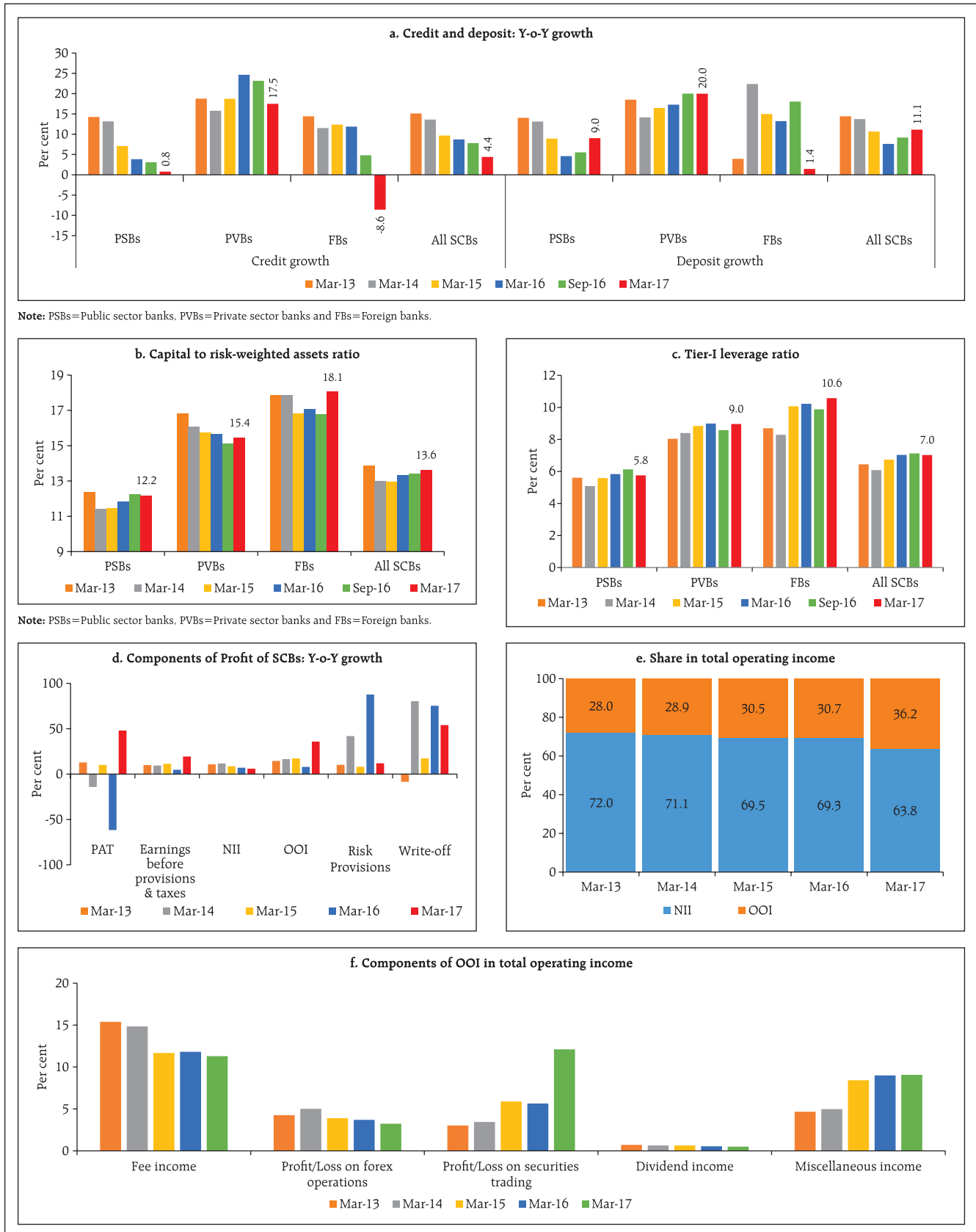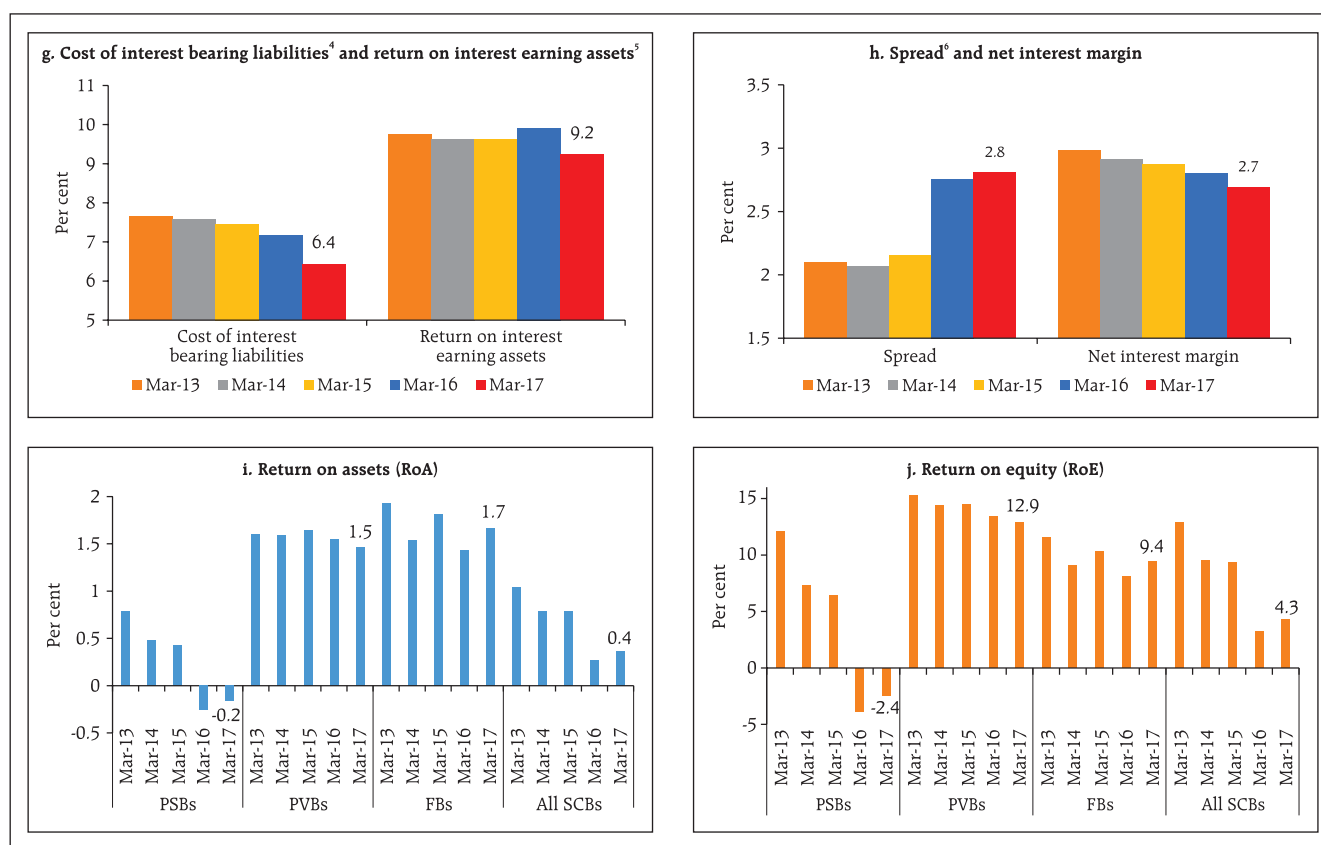**Chart 2.1: Select performance indicators of SCBs**

a. Credit and deposit: Y-o-Y growth

Note: PSBs=Public sector banks, PVBs=Private sector banks and FBs=Foreign banks.

b. Capital to risk-weighted assets ratio

Note: PSBs=Public sector banks, PVBs=Private sector banks and FBs=Foreign banks.

c. Tier-I leverage ratio

d. Components of Profit of SCBs: Y-o-Y growth

e. Share in total operating income

f. Components of OOI in total operating income

Chart 2.1: Select performance indicators of SCBs *(Concld.)*

g. Cost of interest bearing liabilities[4] and return on interest earning assets[5]

h. Spread[6] and net interest margin

i. Return on assets (RoA)

j. Return on equity (RoE)

Source: RBI supervisory returns.

Asset quality

2.4   The gross non-performing advances (GNPAs) ratio of SCBs rose from 9.2 per cent in September 2016 to 9.6 per cent in March 2017. The net non-performing advances (NNPAs) ratio of SCBs increased marginally from 5.4 per cent in September 2016 to 5.5 per cent in March 2017. The stressed advances[7] ratio declined from 12.3 per cent to 12.0 per cent due to fall in restructured standard advances. While there is a fall in stressed advances ratio in agriculture, services and retail sectors, the stressed advances ratio in industry sector, however, rose from 22.3 per cent to 23.0 per cent mainly on account of sub-sectors such as cement, vehicle, mining & quarrying and basic metals. Accretion of new NPAs from restructured standard advances declined in 2016-17 (Chart 2.2).

Credit quality of large borrowers[8]

2.5   Large borrowers account for 56 per cent of gross advances and 86.5 per cent of GNPAs of SCBs, whereas, top 100 large exposures account for 15.2 per cent of gross advances. Non-performing accounts within top 100 exposures contribute to 25.6 per cent of GNPAs of SCBs. While the level of GNPAs of large borrowers increased between September 2016 and March 2017, their restructured standard advances declined during the same period resulting in reduction of total stressed advances by 1.8 per cent.

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[4] Cost of interest bearing liabilities was calculated as the ratio of interest expenses to average interest bearing liabilities.
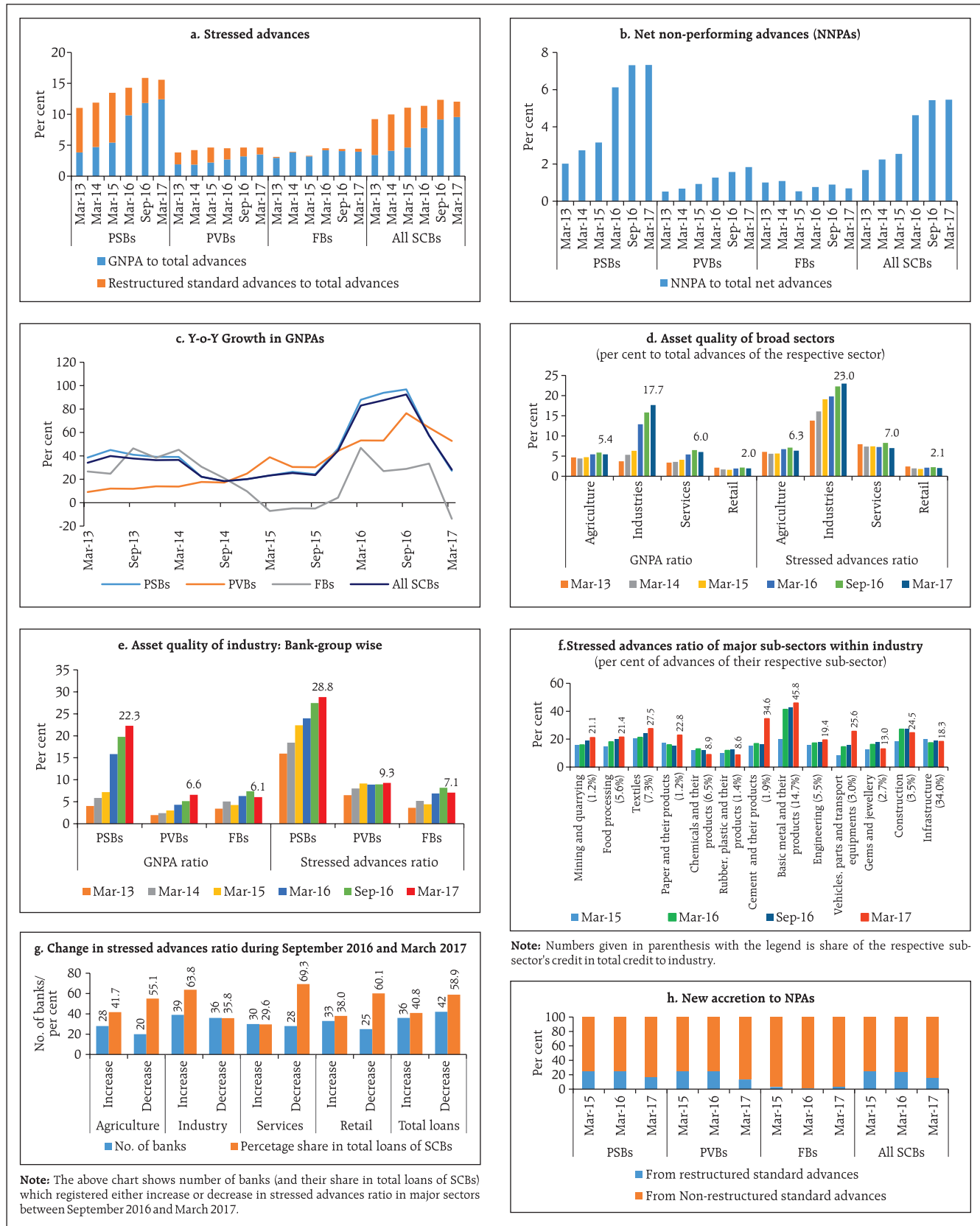
[5] Return on interest earning assets was calculated as the ratio of interest income to average interest earning assets.

[6] Spread was calculated as difference between return on interest earning assets and cost of interest bearing liabilities.

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

[8] A large borrower is defined as one who has aggregate fund-based and non-fund based exposure of ₹50 million and more. This analysis is based on SCBs' global operation.

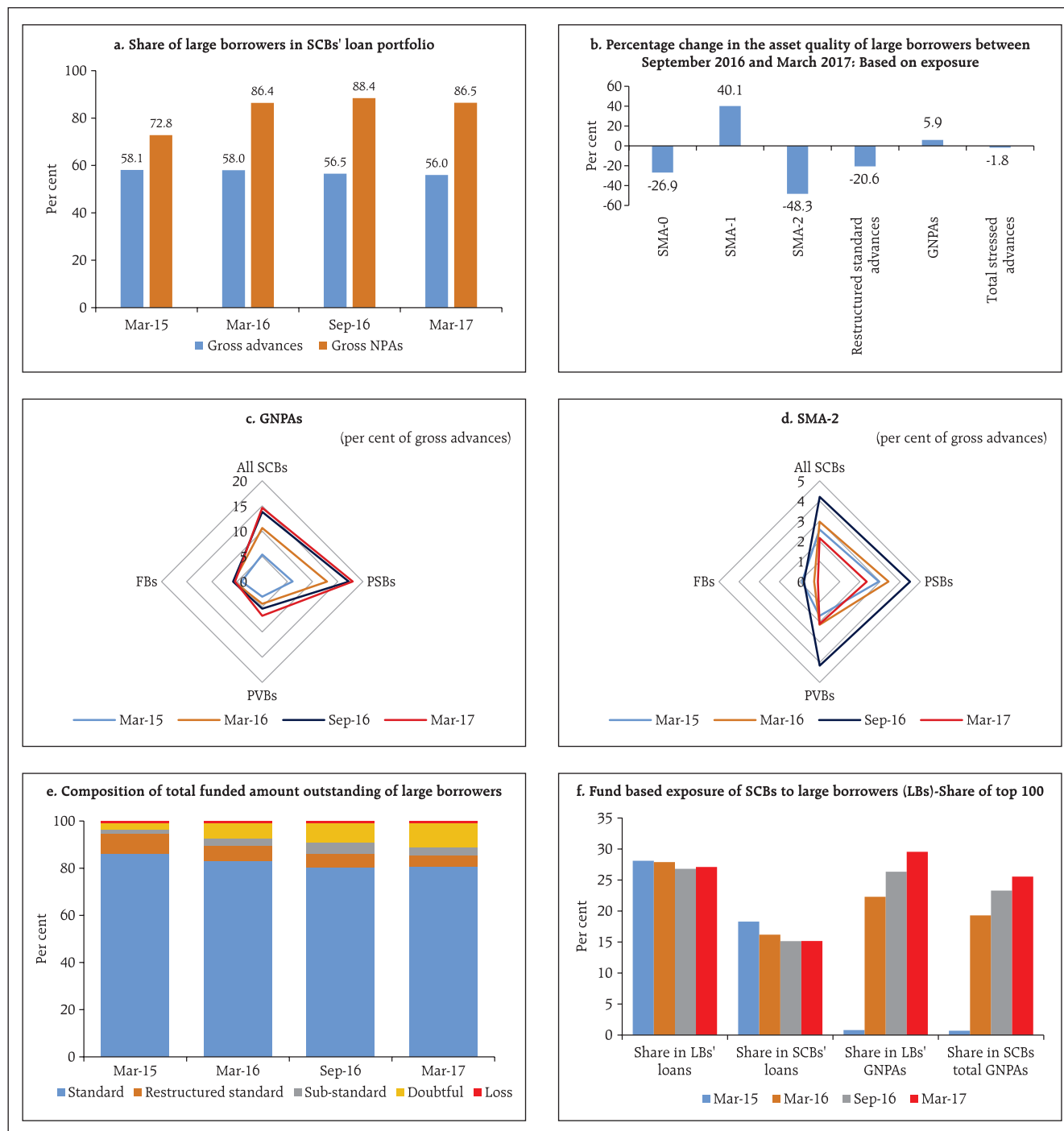**Chart 2.2: Select asset quality indicators of SCBs**

a. Stressed advances

b. Net non-performing advances (NNPAs)

c. Y-o-Y Growth in GNPAs

d. Asset quality of broad sectors
(per cent to total advances of the respective sector)

e. Asset quality of industry: Bank-group wise

f. Stressed advances ratio of major sub-sectors within industry
(per cent of advances of their respective sub-sector)

Note: Numbers given in parenthesis with the legend is share of the respective sub-sector's credit in total credit to industry.

g. Change in stressed advances ratio during September 2016 and March 2017

h. New accretion to NPAs

Note: The above chart shows number of banks (and their share in total loans of SCBs) which registered either increase or decrease in stressed advances ratio in major sectors between September 2016 and March 2017.

Source: RBI supervisory returns.

The category 2 of special mention accounts[9] (SMA-2) as percentage of gross advances also declined across bank-groups. Moreover, the share of large borrowers in SCBs' total loans as well as GNPAs showed a reduction between September 2016 and March 2017 (Chart 2.3).

Chart 2.3: Select asset quality indicators of large borrowers of SCBs

a. Share of large borrowers in SCBs' loan portfolio

b. Percentage change in the asset quality of large borrowers between September 2016 and March 2017: Based on exposure

c. GNPAs (per cent of gross advances)

d. SMA-2 (per cent of gross advances)

e. Composition of total funded amount outstanding of large borrowers

f. Fund based exposure of SCBs to large borrowers (LBs)-Share of top 100

Source: RBI supervisory returns.

[9] Before a loan account turns into a NPA banks are required to identify incipient stress in the account by creating three sub-asset categories of SMAs: 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.

Risks

Banking stability indicator

2.6   The banking stability indicator (BSI) worsened between September 2016 and March 2017. While the soundness, reflecting the capital position, showed improvement, the asset quality and profitability deteriorated further (Charts 2.4 and 2.5).

Resilience – Stress tests

Macro stress test-Credit risk [10]

2.7   The resilience of the Indian banking system against macroeconomic shocks was tested through a macro stress test for credit risk. These tests encompassed assumed baseline and two (medium and severe) adverse macroeconomic stress scenarios (Chart 2.6). The adverse scenarios were derived based on standard deviation in the historical values of the macroeconomic variables: up to 1 standard deviation (SD) for medium stress and 1.25 to 2 SD for severe stress (10 years historical data).

Chart 2.4: Banking stability indicator
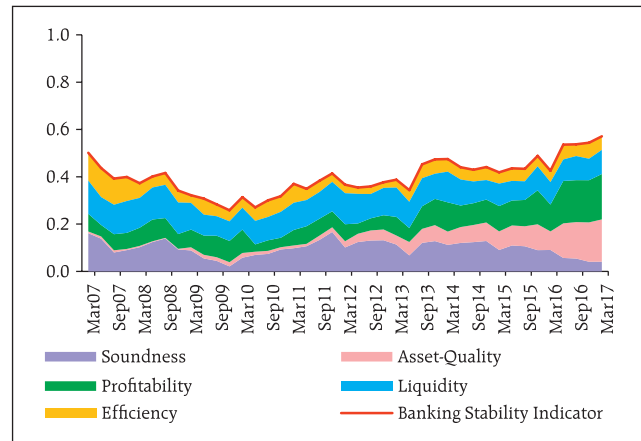
Note: Increase in indicator value shows lower stability. The width of each dimension signifies its contribution towards risk.
Source: RBI supervisory returns and staff calculations.

Chart 2.5: Banking stability map
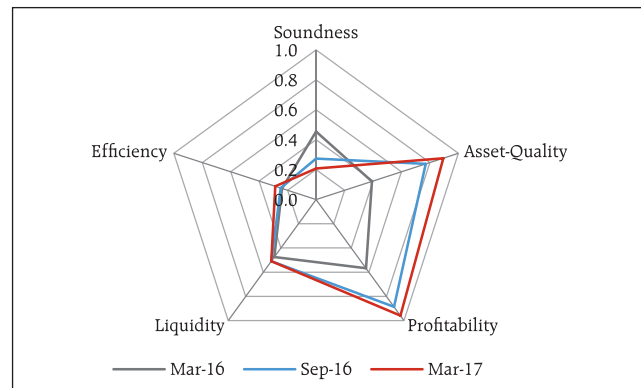
Note: Away from the centre signifies increase in risk.
**Source**: RBI supervisory returns and staff calculations.

Chart 2.6: Macroeconomic scenario assumptions[11]

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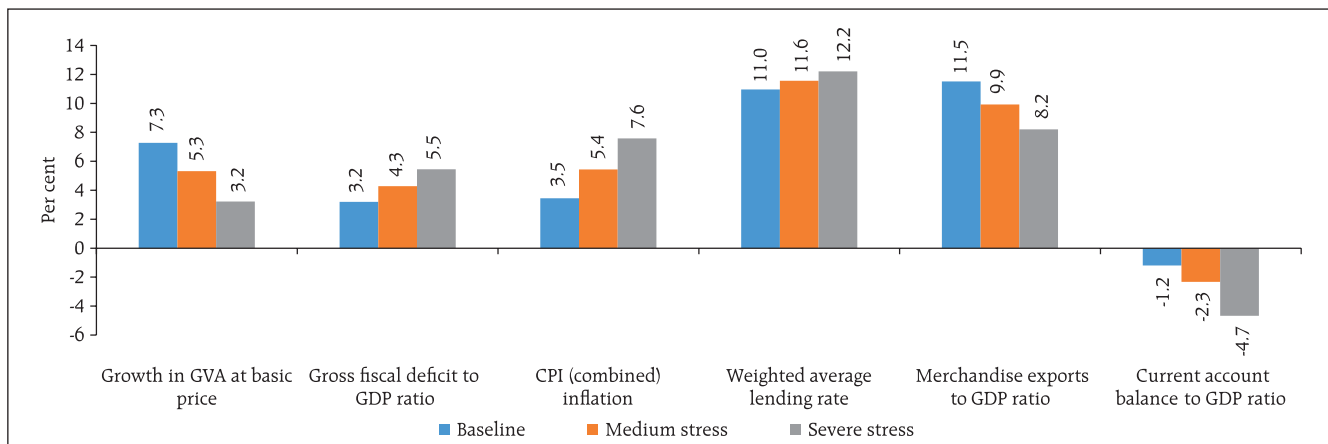
[10] Until now, the projections of capital adequacy of SCBs under assumed macro scenarios were being done assuming a fixed growth in risk-weighted assets (RWAs). Now for the first time, the growth in RWAs has been modelled dynamically bank-by-bank under assumed macro scenario using Internal Rating Based (IRB) formula for select 55 banks which account for 99 per cent of total SCBs' assets. The detailed methodology is given in Annex 2.

[11] These stress scenarios are stringent and conservative assessments under hypothetically severe adverse economic conditions and should not be interpreted as forecasts or expected outcomes.

Chart 2.7: Projection of GNPAs of SCBs
(under various scenarios)
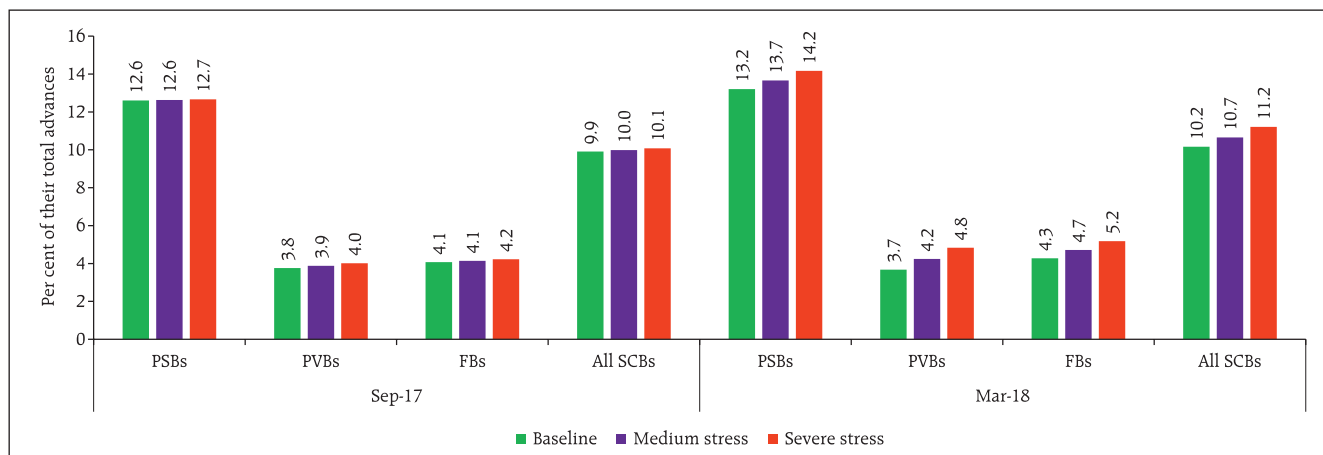
Note: The projection of system level GNPAs has been done using three different, but complementary econometric models: multivariate regression, vector autoregressive (VAR) and quantile regression (which can deal with tail risks and takes into account the non-linear impact of macroeconomic shocks). The average GNPA ratio of these three models is given in the chart. However, in the case of bank-groups, two models namely multivariate regression and VAR are used.
Source: RBI supervisory returns and staff calculations.

2.8   The stress test indicated that under the baseline scenario, the average GNPA ratio of all SCBs may increase from 9.6 per cent in March 2017 to 10.2 per cent by March 2018. However, if the macroeconomic conditions deteriorate, the GNPA ratio may increase further under such consequential stress scenarios (Chart 2.7).

2.9   Under the assumed baseline macro scenario, two banks may have CRAR below minimum regulatory level of 9 per cent by March 2018. However, if macro conditions deteriorate, six banks may record CRAR below 9 per cent under severe macro stress scenario. Under such severe stress scenario, the system level CRAR may decline from 13.3 per cent in March 2017 to 11.2 per cent by March 2018 (Chart 2.8).

Chart 2.8: Projection of CRAR
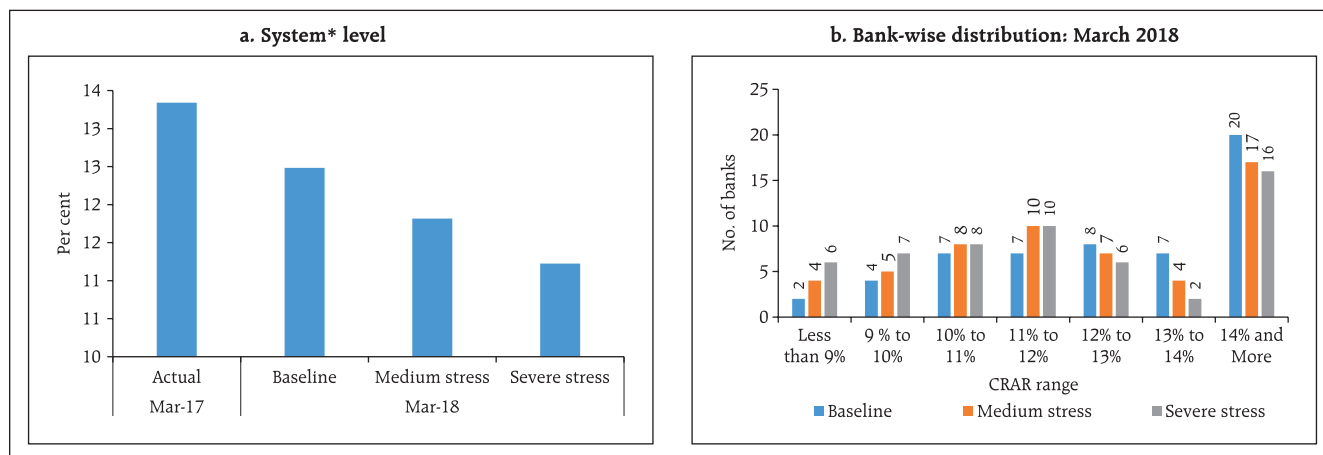
* System of 55 select banks.
Note: The capital projection is made under a conservative assumption of minimum profit transfer to capital reserves at 25 per cent. It does not take into account any capital infusion by stake holders.
Source: RBI supervisory returns and staff calculations.

2.10 Under such severe stress scenario, one bank may have common equity Tier 1 (CET 1) capital to risk-weighted assets ratio below minimum regulatory required level of 5.5 per cent by March 2018. The system level CET 1 capital ratio may decline from 10.2 per cent in March 2017 to 8.6 per cent by March 2018 (Chart 2.9).

Sensitivity analysis: Bank level [12]

2.11 A number of single factor sensitivity stress tests[13] (top-down), based on March 2017 data, were carried out on SCBs[14] to assess their vulnerabilities and resilience under various scenarios.[15] The same set of shocks was used on select SCBs to conduct bottom-up stress tests. SCBs' resilience with respect to credit, interest rate, and liquidity risks as also due to drop in equity prices was studied.

Credit risk

2.12 A severe credit shock is likely to impact capital adequacy and profitability of a significant number of banks. Under a severe shock of 3 SD[16] (that is, if the average GNPA ratio of 59 select SCBs moves up to 15.6 per cent from 9.6 per cent), the system level CRAR and Tier-1 CRAR will decline to 10.4 per cent and 7.9 per cent respectively. The impairment in capital at the system level could be about 24 per cent. Reverse stress test results show that it requires a shock of 4.33 SD to bring down the system level CRAR to 9 per cent. On the other hand, the SCBs would lose their entire annual profit before tax (PBT) of FY 2016-17 if the GNPA ratio moves up by 0.71 SD to 11 per cent. At the individual bank-level, the stress test results show that 25 banks having a

Chart 2.9: Projection of CET 1 capital ratio
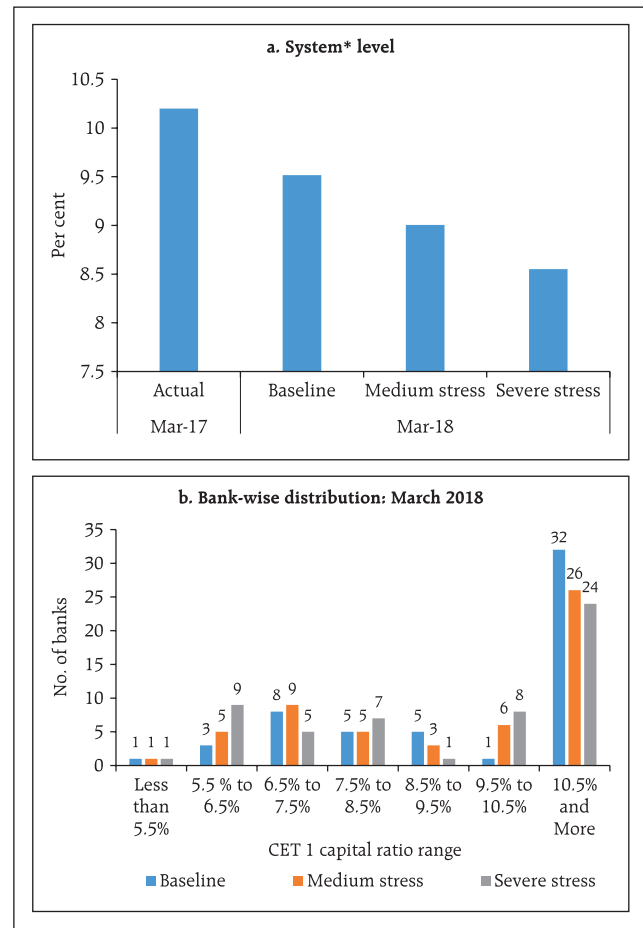
* System of 55 select banks.
Note: The capital projection is made under a conservative assumption of minimum profit transfer to capital reserves at 25 per cent. It does not take into account any capital infusion by stake holders.
Source: RBI supervisory returns and staff calculations.

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[12] 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. While the focus of the macro stress tests was credit risk, the sensitivity analysis covered credit, interest rate and liquidity risks.

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

[14] Single factor sensitivity analysis stress tests were conducted for a sample of 59 SCBs accounting for 99 per cent assets of the total banking sector.

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

[16] The SD of the GNPA ratio is estimated using quarterly data since 2003. One SD shock approximates a 21 per cent increase in GNPAs.

**Chart 2.10: Credit risk – Shocks and impacts**
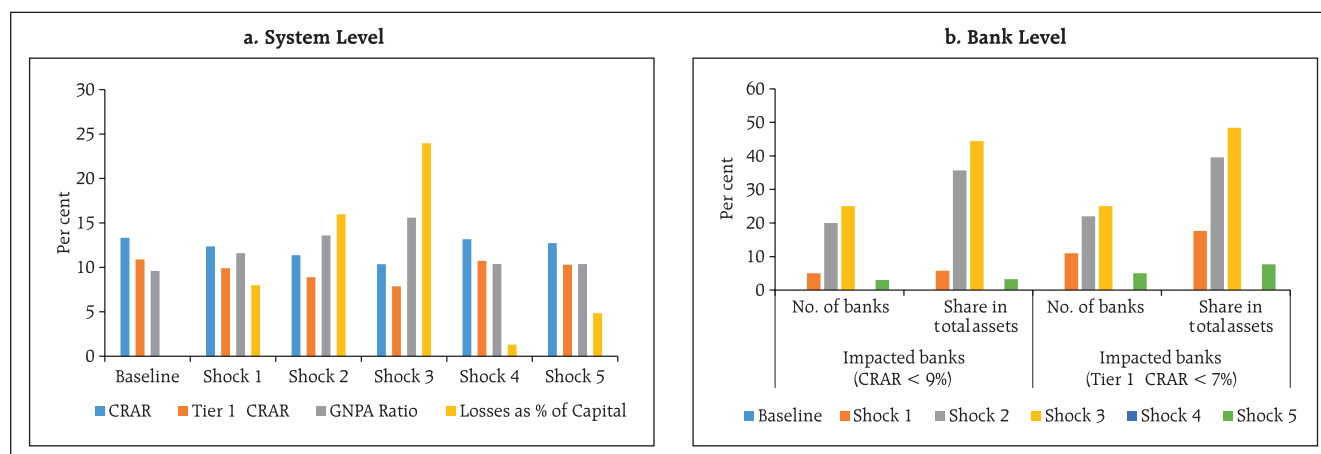
Shock 1: 1 SD shock on NPAs
Shock 2: 2 SD shock on NPAs
Shock 3: 3 SD shock on NPAs
Shock 4: 30 per cent of restructured advances turn into NPAs (Sub-standard category)
Shock 5: 30 per cent of restructured advances turn into NPAs (Loss category) – written off
Note: System of select 59 SCBs.
Source: RBI supervisory returns and staff calculations.

share of 44.4 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 with the CRAR of 22 PSBs likely to go down below 9 per cent (Charts 2.10 and 2.11).

Credit concentration risk

2.13   Stress tests on banks' credit concentration risks on their stressed advances portfolio showed that 12 banks, comprising about 12 per cent of the assets, may fail[17] to maintain 9 per cent CRAR in the extreme scenario of the top 3 individual borrowers failing to repay. The impact could be 103.6 per cent of PBT under the scenario of a default by the most stressed borrower and 154.5 per cent in case the top two stressed borrowers fail. The impact on CRAR at the system level under the assumed scenarios of failure of the top one, two and three stressed
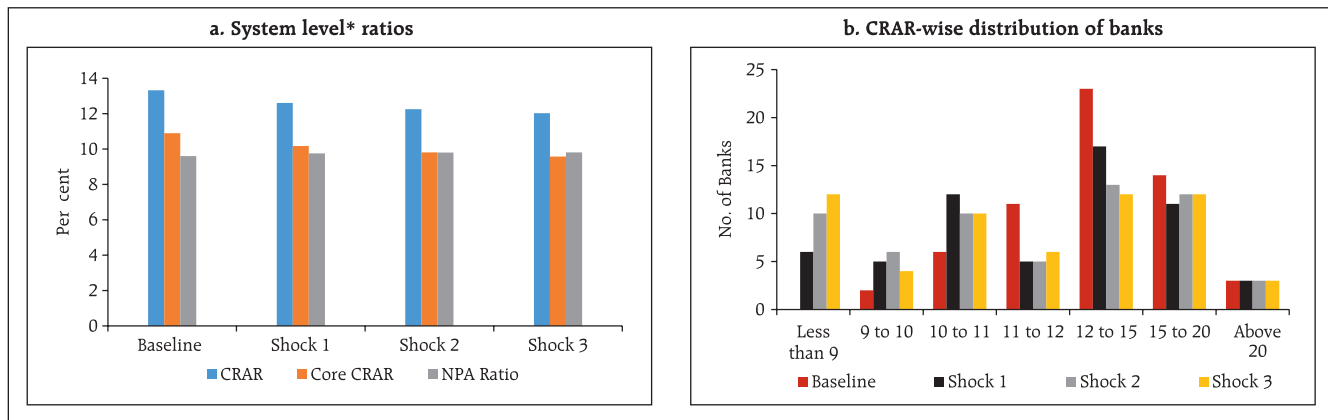
Chart 2.11: CRAR-wise distribution of banks
(under a 3 SD shock on GNPA ratio)
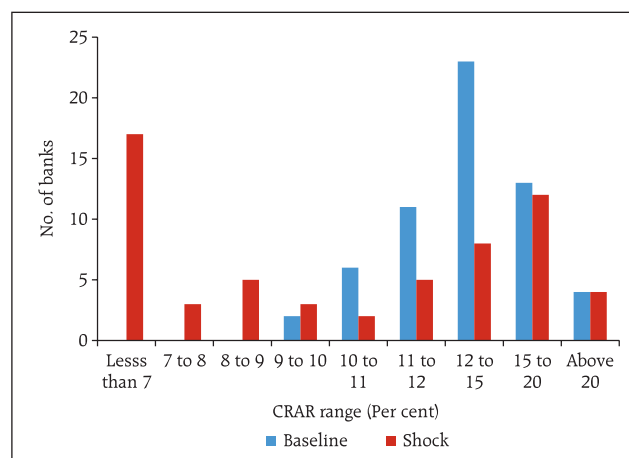
Note: System of select 59 SCBs.
Source: RBI supervisory returns and staff calculations.

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

Chart 2.12: 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 42 SCBs.
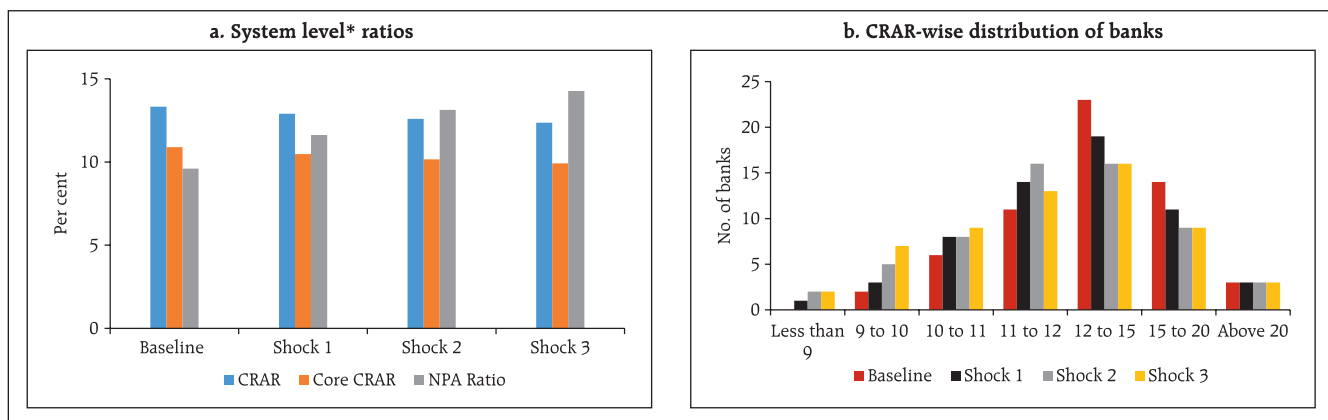**Source:** RBI supervisory returns and staff calculations.

borrowers will be 71, 107 and 130 basis points (Chart 2.12).

2.14   Stress tests on banks' credit concentration risks, considering top individual borrowers according to their exposures, showed that the impact[18] (under three different scenarios) was significant for two banks, comprising about 1 per cent of the aggregate assets, which may fail to maintain 9 per cent CRAR in at least one of the scenarios. The losses could be 60 per cent of PBT under the scenario of a default by the top individual borrower and 105 per cent in case

the top two individual borrowers default. The impact on CRAR at the system level under the assumed scenarios of default by the top three individual borrowers will be 96 basis points (Chart 2.13).

2.15   In order to ascertain the vulnerability of individual banks to credit concentration, simulation under five different stress scenarios wherein top group borrowers of individual banks default simultaneously was carried out. The losses could be around 6.7 per cent and 12.3 per cent of the capital at the system level under the assumed scenarios of

Chart 2.13: 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 59 SCBs.
Source: RBI supervisory returns and staff calculations.

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

Table 2.1: 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)	13.3	10.9	9.6	---	No. of banks	Share in total assets of SCBs (in %)
Shock 1 The top 1 group borrower defaults	12.5	10.1	13.6	6.7	2	1.0
Shock 2 The top 2 group borrowers default	11.8	9.4	16.9	12.3	3	2.9
Shock 3 The top 3 group borrowers default	11.2	8.8	19.7	16.9	7	11.8
Shock 4 The top 4 group borrowers default	10.7	8.3	22.0	20.9	9	16.4
Shock 5 The top 5 group borrowers default	10.3	7.8	24.1	24.4	10	21.4

Note: * System of select 58 SCBs.
**Source:** RBI supervisory returns and staff calculations

default[19] by the top group borrower and the top two group borrowers of individual banks. As many as 10 banks will not be able to maintain their CRAR level at 9 per cent if top five group borrowers default (Table 2.1).

Sectoral credit risk

2.16   Credit risk arising from exposure to the infrastructure sector (specifically power, transport and telecommunications) was examined through a sectoral credit stress test where GNPA ratio of the sector was assumed to increase by a fixed percentage point impacting the overall GNPA ratio of the banking system. The results showed that shocks to the infrastructure segment will considerably impact the profitability of banks, with the most severe shock (15 per cent of restructured standard advances and 10 per cent of standard advances become NPAs and move to the loss category) completely wiping out the recorded profits of FY 2016-17. The most significant effect of the single factor shock appears to be on the power and transport sectors (Chart 2.14).

Chart 2.14: Sectoral credit risk: Infrastructure – shocks and impacts

a. NPA ratio of the system

b. Losses as per cent of profit of FY 2016-17
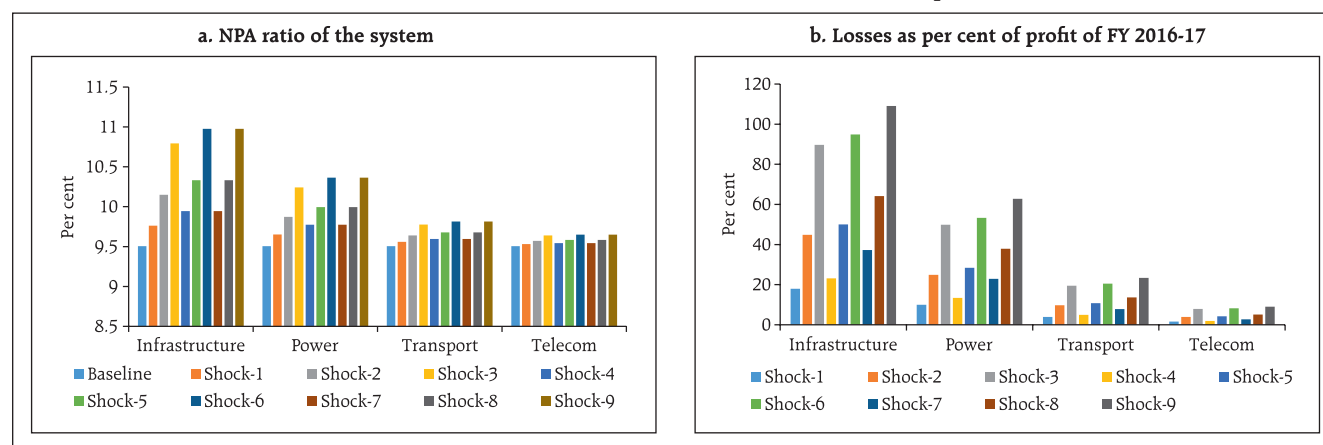
Shocks	Shock-1	Shock-2	Shock-3	Shock-4	Shock-5	Shock-6	Shock-7	Shock-8	Shock-9
Shock on Restructured Standard Advances [&]	0			15			15		
Shock on other Standard Advances [#]	2	5	10	2	5	10	2	5	10

[&] 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 percentage increase in the sectoral NPA ratio and conversion of a portion of restructured standard advances into NPAs. The new NPAs arising out of standard advances (other than restructured standard advances) have been assumed to be distributed among different asset classes (following the existing pattern) in the shock scenario.
Source: RBI supervisory returns and staff calculations.

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

Interest rate risk

2.17   For investments under available for sale (AFS) and held for trading (HFT) categories (direct impact), a parallel upward shift of 2.5 percentage points in the yield curve will lower the CRAR by about 109 basis points at the system level (Table 2.2). At the disaggregated level, five banks accounting for about 5.3 per cent of the total assets could be impacted adversely with their CRAR falling below 9 per cent. The total loss of capital at the system level is estimated to be about 9.2 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 (MTM), will reduce the CRAR by about 279 basis points resulting in 21 banks' CRAR falling below 9 per cent. The income impact on SCBs' banking books[20] could be about 24.9 per cent of their latest annual PBT under the assumed shock of a parallel downward shift of 2.5 percentage points in the yield curve.[21]

Equity price risk

2.18   Under the equity price risk, impact of a shock of a fall in the equity price index, by 25, 35 and 55 per cent, on bank capital was examined. The system-wide CRAR would decline by only 36 basis points from the baseline under the 55 per cent drop scenario, while the average CRAR for the banks remains well above 9 per cent (Chart 2.15). Impact of the equity price index drop is extremely limited for the overall system because the banks typically have low proportion of capital market exposures on their balance sheets, considering the regulatory limit prescribed on banks' exposures to capital markets.

Table 2.2: 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	4.0	4.9	2.5	5.2	1.1	3.8
Share in total investments	37.1	0.2	34.3	3.3	86.0	14.0
Reduction in CRAR (bps)	134		51		151	

Source: RBI supervisory returns and staff calculations.

Chart 2.15: Equity price risk
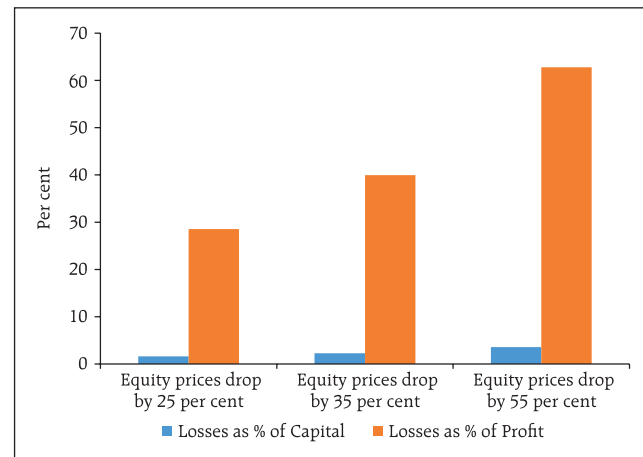
Source: RBI supervisory returns and staff calculations.

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[20] 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.

[21] The stress test results give the conservative estimates by considering the movements which may result in losses for banks. For a parallel upward shift of 2.5 percentage points in the yield curve, the valuation loss in trading books may be 9.2 per cent of capital or about 148 per cent of total annual profits of SCBs. On the other hand the income gain in banking books, for the same shock, may be about 25 per cent of the total annual profits of SCBs or 1.6 per cent of capital. Therefore, for a parallel upward (downward) shift in the yield curve by 2.5 percentage points, the net loss (gain) may be 7.7 per cent of capital or about 123 per cent of total annual profits of SCBs.

Liquidity risk

2.19   The liquidity risk analysis aims to capture the impact of deposit run-offs and increased demand for the unutilised portions of credit lines which were sanctioned/committed/guaranteed. Banks in general are expected to withstand liquidity shocks with their high quality liquid assets (HQLAs)[22] and statutory liquidity ratio (SLR) investments. In assumed scenarios, there will be increased withdrawals of un-insured deposits[23] 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 utilisation of credit commitments and guarantees extended by banks to their customers.

2.20   Using their HQLAs required for meeting day-to-day liquidity requirements, most banks (51 out of the 59 banks in the sample) will remain resilient in a scenario of assumed sudden and unexpected withdrawals of around 12 per cent of deposits along with the utilisation of 75 per cent of their committed credit lines (Chart 2.16). The residual SLR portfolios of SCBs offer further resilience (Chart 2.17).

Chart 2.16: Liquidity risk – Shocks and impacts using HQLAs
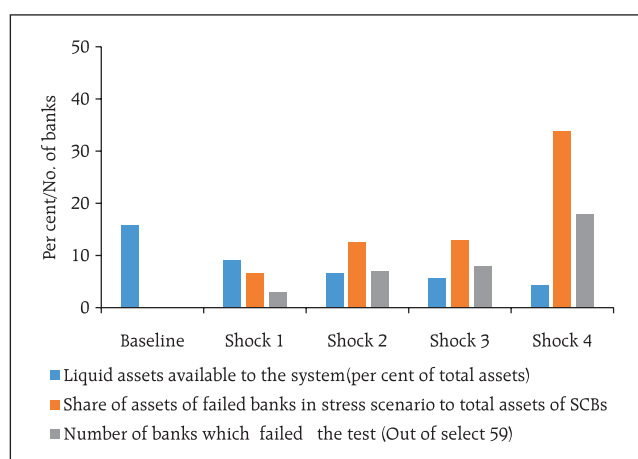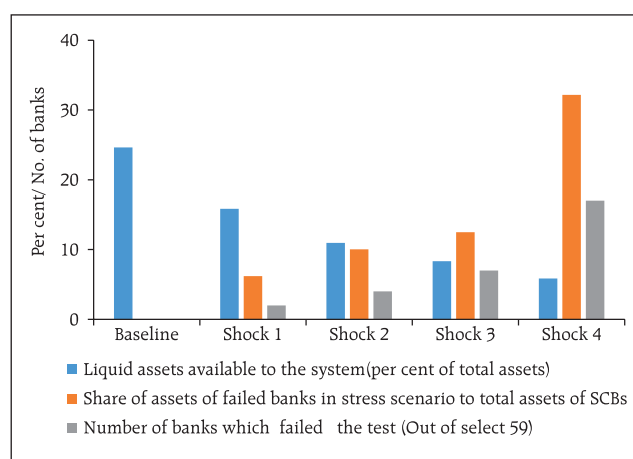(using HQLAs for liquidity support)

Chart 2.17: Liquidity risk – Shocks and impacts
(using full SLR along with excess CRR for liquidity support)

Note: 1. A bank was considered 'failed' in the test when it was unable to meet the requirements under stress scenarios (on imparting shocks) with the help of its liquid assets (stock of liquid assets turned negative under stress conditions).
2. Shocks: Liquidity shocks include 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) and also a withdrawal of a portion of un-insured deposits as given below:
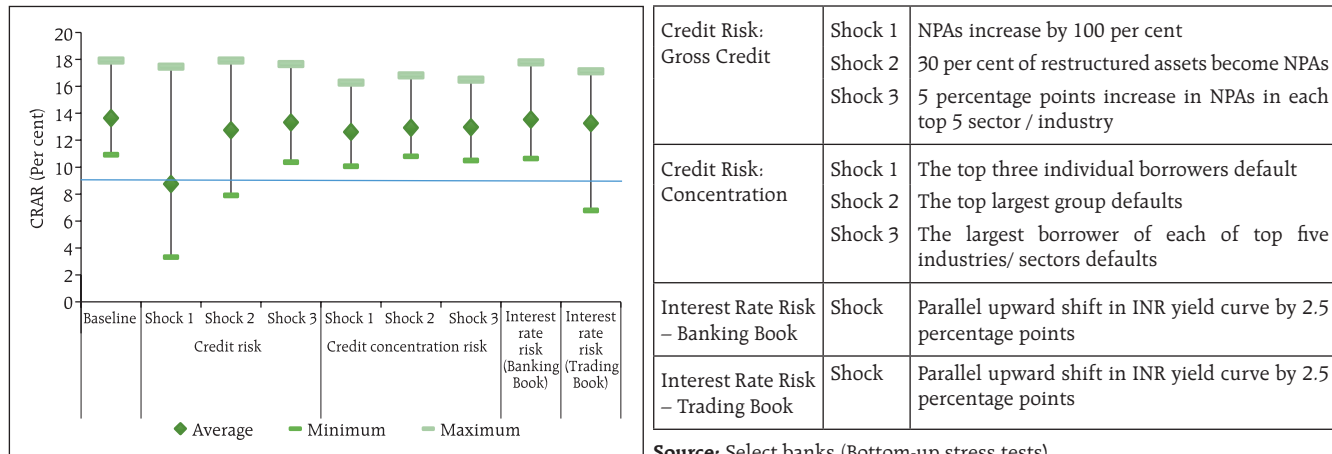
	HQLAs liquidity Support	Full SLR along with excess CRR as liquidity support
Shock 1 :	5 per cent	10 per cent
Shock 2 :	10 per cent	20 per cent
Shock 3 :	12 per cent	25 per cent
Shock 4 :	15 per cent	30 per cent

Source: RBI supervisory returns and staff calculations.

[22] In view of the implementation of the liquidity coverage ratio (LCR) with effect from January 1, 2015 in India, definition of liquid assets was revised for stress testing. For this 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), additional SLR investments at 9 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. 2/21.04.098/2016-17 dated July 21, 2016).

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

Chart 2.18: Bottom-up stress tests – Credit and market risks – Impact on CRAR

Credit Risk: Gross Credit	Shock 1	NPAs increase by 100 per cent
	Shock 2	30 per cent of restructured assets become NPAs
	Shock 3	5 percentage points increase in NPAs in each top 5 sector / industry
Credit Risk: Concentration	Shock 1	The top three individual borrowers default
	Shock 2	The top largest group defaults
	Shock 3	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).

Bottom-up stress tests

2.21   A series of bottom-up stress tests (sensitivity analyses) were conducted for the select sample banks,[24] with the reference date as on March 31, 2017. 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 2.18).

2.22   The results of bottom-up stress tests for liquidity risk show the impact of liquidity shocks on select banks. Liquid assets ratios[25] using various definitions reflect the liquidity position of (select) banks under different scenarios. The results show that SLR investments and cash reserve ratio (CRR) deposits would help the banks sustain themselves against the liquidity pressure from sudden and unexpected withdrawal of deposits by depositors.

The banks have higher liquid asset ratios compared to the exercise last year given the increased assets allowed as HQLA[26] and the general increase in liquidity following the withdrawal of specified bank notes (SBNs) in November 2016 (Chart 2.19).

Chart 2.19: Bottom-up stress tests – Liquidity risk
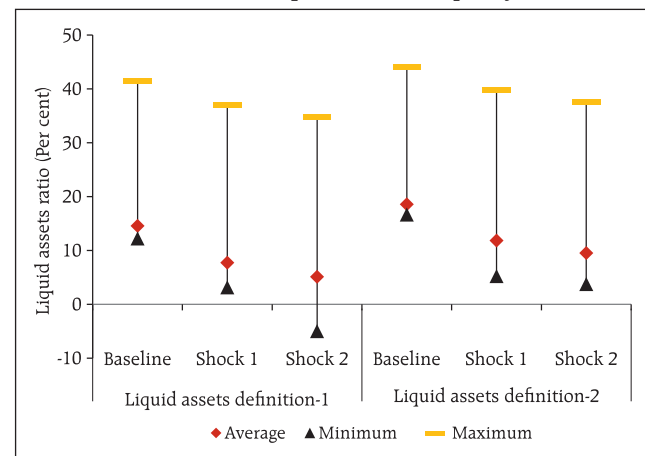
Liquid Assets Definitions
1 HQLAs as per Liquidity Coverage Ratio (LCR) guidelines.
2 Cash including cash reserves in excess of minimum regulatory CRR + Entire SLR Investments

Liquidity Shocks
Shock 1 10 per cent deposits withdrawal (cumulative) during a short period (say 1 or 2 days)
Shock 2 3 per cent deposits withdrawal (each day) within 5 days.

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

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[24] Stress tests on various shocks were conducted on a sample of 19 select banks. A same set of shocks was used for conducting top-down and bottom-up stress tests. Details of these are given in Annex 2.

[25] Liquid Assets Ratio $= \dfrac{\text{Liquid Assets}}{\text{Total Assets}}$ x 100. Under shock scenarios, the negative liquid assets ratio reflects the percentage deficit in meeting the required deposit withdrawal.

[26] Vide RBI circular DBR.BP.BC.No.2/21.04.098/2016-17 dated July 21, 2016, banks have been permitted to reckon government securities held by them up to another 1 per cent of their NDTL under FALLCR within the mandatory SLR requirement as level 1 HQLA for the purpose of computing their LCR. Hence, the total carve-out from SLR available to banks would be 11 per cent of their NDTL.
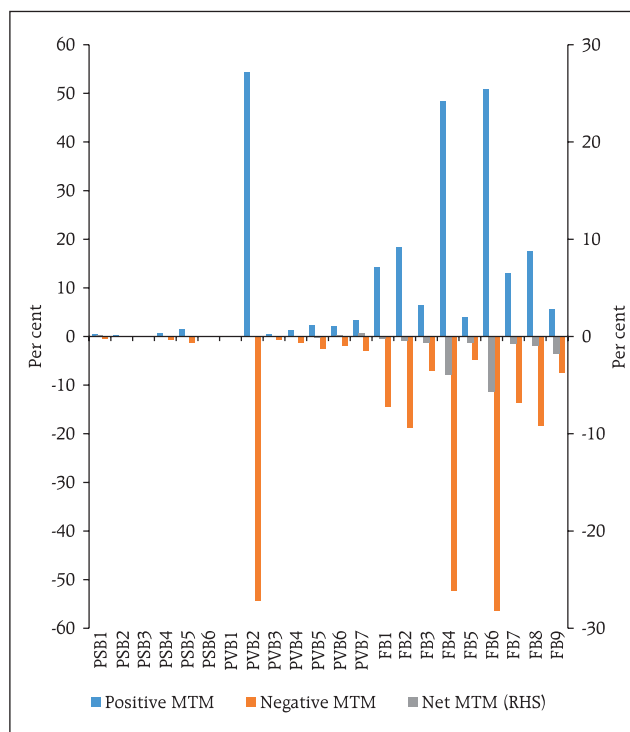
Stress testing the derivatives portfolio of banks

2.23   A series of bottom-up stress tests (sensitivity analyses) on derivative portfolios were conducted for select sample banks[27] with the reference date as on March 31, 2017. The banks in the sample, reported the results of four separate shocks on interest and foreign exchange rates. 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.

2.24   In the sample, the MTM value of the derivatives portfolio for the banks varied with PSBs and PVBs, except one, registering small MTM, while FBs had a relatively large positive as well as negative MTM. Most of the PSBs and PVBs had positive net MTM, while most of the FBs recorded negative net MTM (Chart 2.20).

2.25   The stress test results showed that the average net impact of interest rate shocks on sample banks were negligible. The foreign exchange shock scenarios showed relatively higher impact in March 2017 (Chart 2.21).

Chart 2.20: MTM of total derivatives – Select banks – March 2017

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

Chart 2.21: Stress tests – Impact of shocks on derivative portfolio of select banks
(change in net MTM on application of a shock)

(per cent to capital funds)
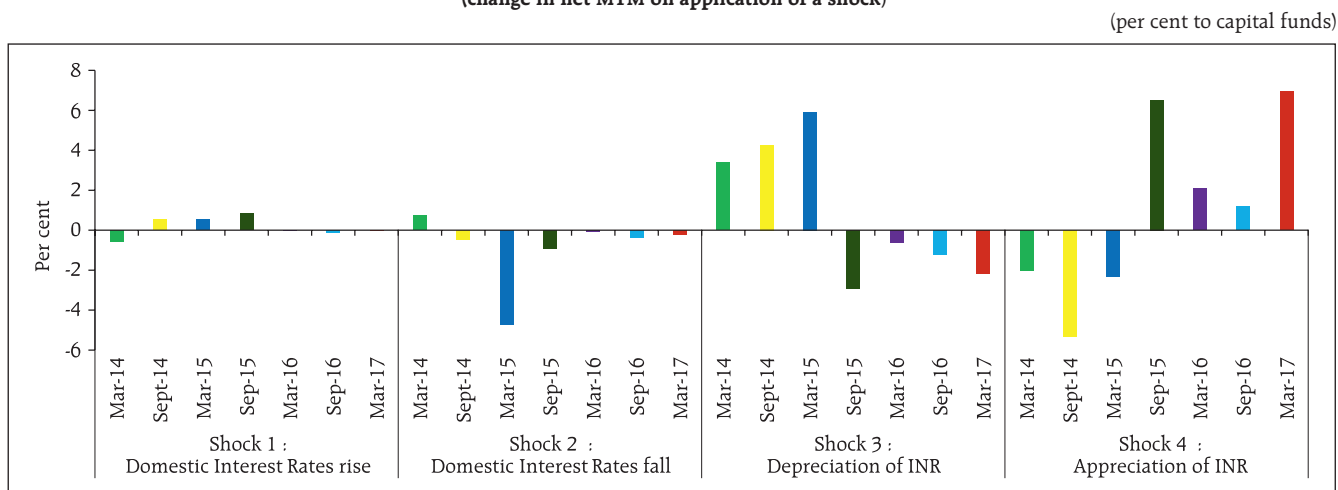
Note: Change in net MTM due to an applied shock with respect to the baseline.
Source: Sample banks (Bottom-up stress tests on derivative portfolio).

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

Section II

Scheduled urban co-operative banks

Performance

2.26   At the system level,[28] the CRAR of scheduled urban co-operative banks (SUCBs) increased from 13.0 per cent to 13.6 per cent between September 2016 and March 2017. However, at a disaggregated level, CRAR of five banks were below the minimum required level of 9 per cent. GNPAs of SUCBs as a percentage of gross advances declined from 8.6 per cent to 7.2 per cent and their provision coverage ratio[29] increased from 47.2 per cent to 54.2 per cent during the same period. Further, RoA declined from 0.9 per cent to 0.6 per cent while the liquidity ratio[30] rose from 34.7 per cent to 35.9 per cent during the same period.

Resilience – Stress tests

Credit risk

2.27   The impact of credit risk shocks on the CRAR of SUCBs was observed under four different scenarios.[31] The results show that under a severe shock (scenario iv) of increase in GNPAs by two SD, which moves into loss category, the system level CRAR of SUCBs may come down below the minimum regulatory requirement. At individual level, a significant number of banks (35 out of 54) may not be able to maintain the minimum CRAR.

Liquidity risk

2.28   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 1 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 may be significantly impacted under a stress scenario (out of 54 banks, 21 banks under Scenario i and 35 banks under Scenario ii).

Section III

Non-banking financial companies

2.29   As of March 2017, there were 11,517 non-banking financial companies (NBFCs) registered with the Reserve Bank, of which 179 are deposit-accepting (NBFCs-D). There were 220 Systemically Important Non-Deposit accepting NBFCs (NBFCs-ND-SI)[32]. All NBFC-D and NBFCs-ND-SI are subjected to prudential regulations such as capital adequacy requirements and provisioning norms along with reporting requirements.

Performance

2.30   The aggregate balance sheet size of the NBFC[33] sector expanded by 14.5 per cent during 2016-17 as compared to 15.5 per cent during 2015-16. Loans and advances increased by 16.4 per cent and investments increased by 11.9 per cent in March 2017 (Table 2.3). In terms of borrowings, commercial paper outstanding rose by 70.3 per cent and debentures outstanding increased by 28.3 per cent as on March 31, 2017, while, bank borrowings declined by 3.7 per cent.

2.31   Net profit was down by 2.9 per cent during 2016-17. Net profit as a percentage of total income also came down from 18.3 per cent in 2015-16 to

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[28] System of 54 SUCBs.

[29] Provision coverage ratio=(provisions held for NPA/GNPAs)*100.

[30] Liquidity ratio = ((cash + due from banks + SLR investment)/total assets)*100.

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

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

[33] Excluding Government Owned NBFCs.

14.0 per cent in 2016-17. RoA and RoE also declined during the same period (Tables 2.3 and 2.4).

Asset quality and capital adequacy

2.32   GNPAs of the NBFC sector as a percentage of total advances declined from 4.9 per cent to 4.4 per cent between September 2016 and March 2017. NNPAs as a percentage of total advances also declined from 2.7 per cent to 2.3 per cent (Chart 2.22).

2.33   As per extant guidelines, NBFCs[34] are required to maintain a minimum capital consisting of Tier-I[35] and Tier-II capital, of not less than 15 per cent of their aggregate risk-weighted assets. The CRAR of NBFCs declined from 23.1 per cent to 22.0 per cent between September 2016 and March 2017 (Chart 2.22).

Resilience – Stress tests

System level

2.34   Stress test on credit risk for NBFC sector as a whole for the period ended March 2017 was carried out under three scenarios: (i) GNPA increasing by 0.5 SD, (ii) GNPA increasing by 1 SD and (iii) GNPA increasing by 3 SD. The results indicate that in the first scenario CRAR of sector may decline to 21.6 per cent from 22.0 per cent, in the second scenario, it may decline to 21.5 per cent and in the third scenario it may decline to 21.0 per cent but remained significantly above the regulatory minimum required level of 15 per cent under all the scenarios.

Individual NBFCs

2.35   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 the first two scenarios, around 8 per cent of companies, will not be able to comply with the

Table 2.3: Consolidated balance sheet of NBFC sector: Y-o-Y growth

(Per cent)

	Mar-16	Mar-17
1. Share Capital	4.8	15.2
2. Reserves and Surplus	14.3	12.2
3. Total Borrowings	15.3	15.0
4. Current Liabilities and Provisions	31.8	16.0
Total Liabilities / Assets	**15.5**	**14.5**
1. Loans & Advances	16.6	16.4
2. Investments	10.8	11.9
3. Others	12.7	7.9
Income/Expenditure		
1.Total Income	15.8	8.9
2. Total Expenditure	15.8	9.6
3. Net Profit	15.6	-2.9

Source: RBI supervisory returns.

Table 2.4: Select ratios of NBFC sector

(Per cent)

	Mar-16	Mar-17
1. Capital market exposure(CME) to total assets	8.5	7.8
2. Real Estate Exposure (REE) to total assets	4.8	5.6
3. Leverage Ratio	2.8	2.8
4. Net Profit to Total Income	18.3	14.0
5. RoA	2.1	1.8
6. RoE	7.9	6.8

Source: RBI supervisory returns.

Chart 2.22: Asset quality and capital adequacy of the NBFC sector
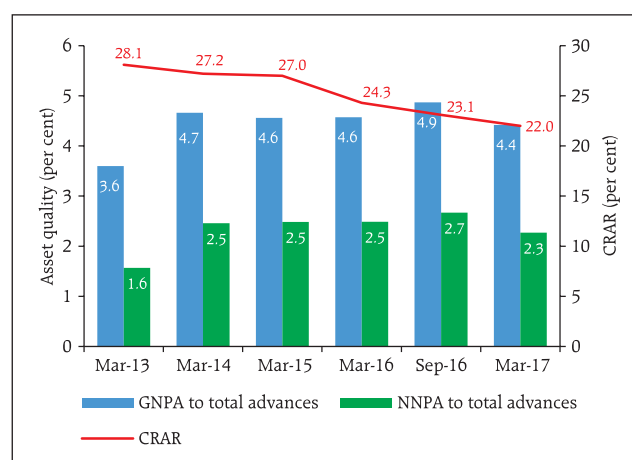
Source: RBI supervisory returns.

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

[35] 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 taking NBFCs was revised up 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).

minimum regulatory capital requirement of 15 per cent, while 11 per cent of companies will not be able to comply with the minimum regulatory CRAR norm under the third scenario.

Section IV

Interconnectedness[36]

Interbank[37] market

2.36   The size of the interbank market increased from ₹7.3 trillion in September 2016 to around ₹8

trillion in March 2017. The interbank exposures constituted nearly 6.2 per cent of the total assets of the banking system in March 2017. Fund-based segment that dominated the interbank market had a share of nearly 84 per cent in March 2017 as against 81 per cent in September 2016 (Chart 2.23).

2.37   PSBs continued to be the largest contributors in the interbank market with a share of 66 per cent followed by PVBs at 21 per cent and FBs at 13 per cent (Chart 2.24).

Chart 2.23: Interbank market
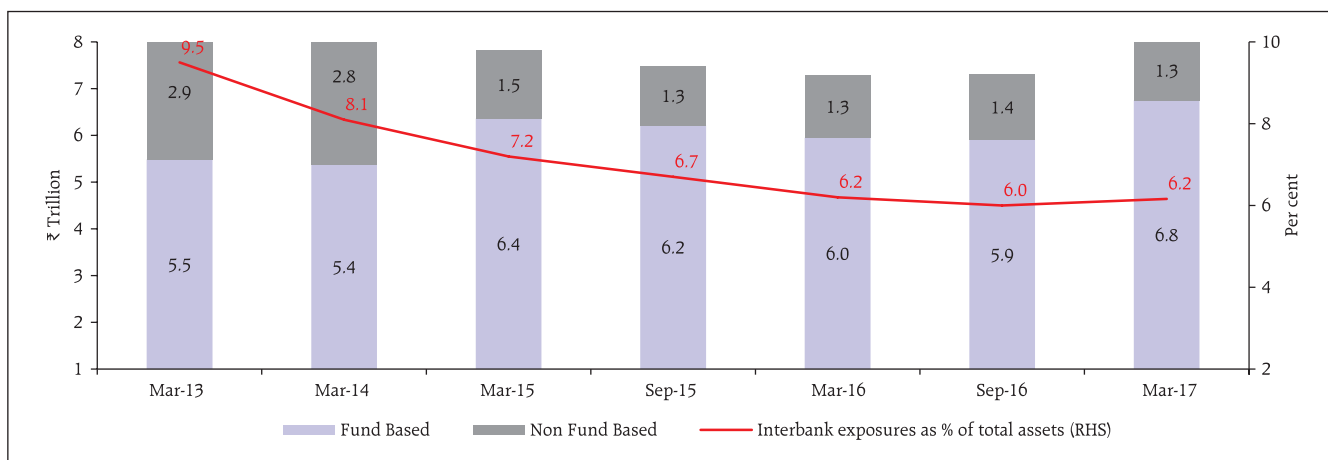
Source: RBI supervisory returns and staff calculations.

Chart 2.24: Share of different bank groups in the Interbank market
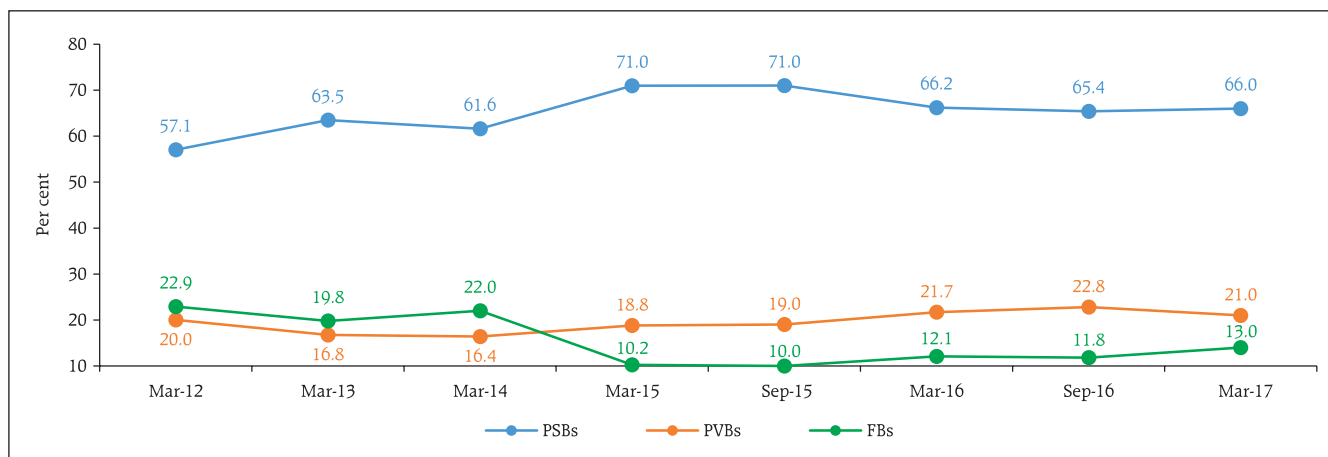
Source: RBI supervisory returns and staff calculations.

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[36] 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.

[37] The analysis is restricted to 88 scheduled commercial banks with data as of March 2017.

2.38   Composition of short-term (ST) fund based (interbank)[38] exposure shows that the highest share is of short-term deposits followed by short-term loans. Similarly, composition of long-term (LT) fund based exposure shows that the highest share is of loans and advances followed by long-term debt instruments (Chart 2.25).

Network structure and connectivity

2.39   The network structure[39] of the banking system showed that the number of dominant banks declined from nine to three during the period from March 2012 to March 2017 (Chart 2.26).

Chart 2.25: Composition of fund based interbank market – March 2017

a. Short-term fund based

b. Long-term fund based
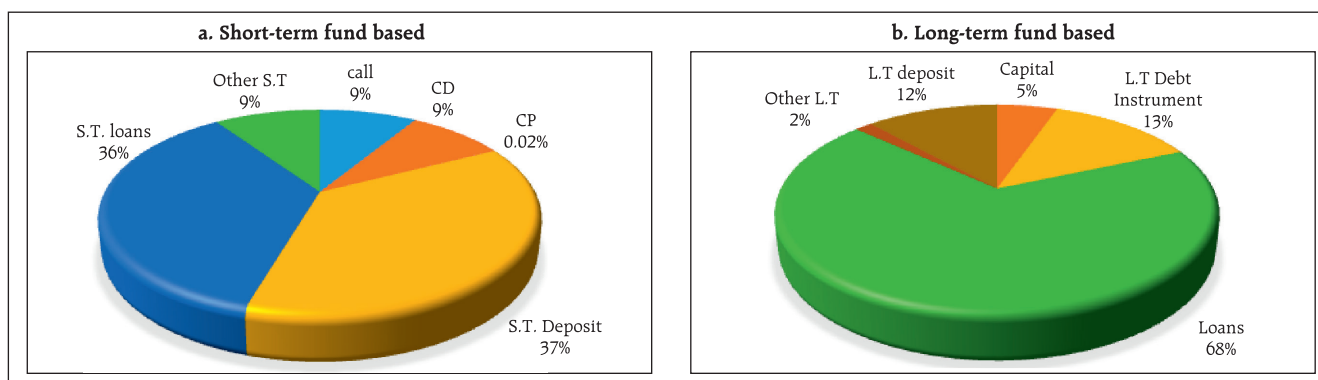
Source: RBI supervisory returns and staff calculations.

Chart 2.26: Network structure of the Indian banking system – March 2017
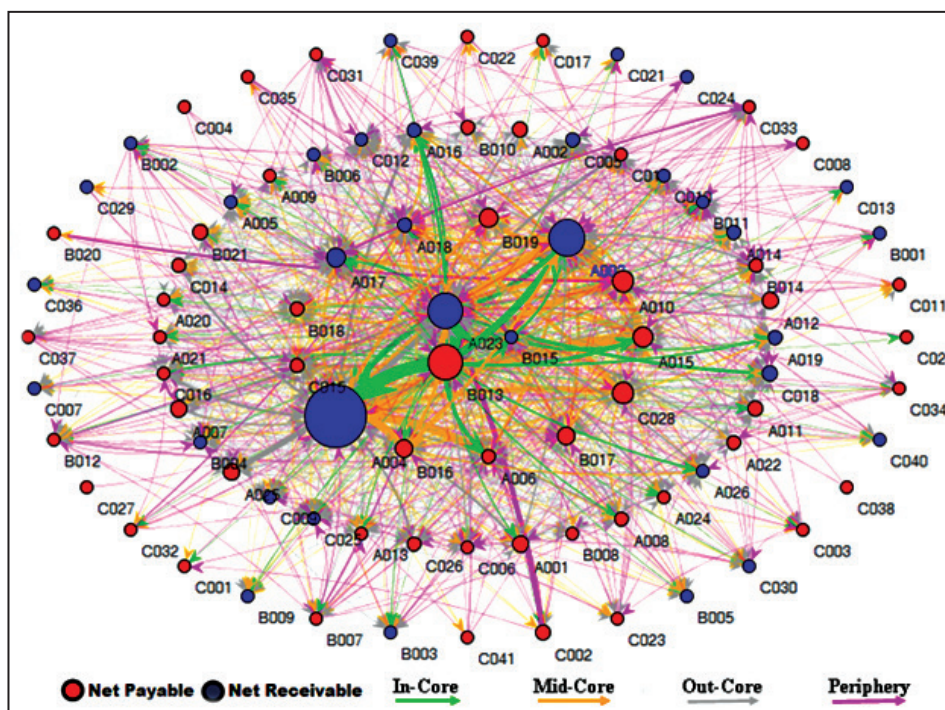
Source: RBI supervisory returns and staff calculations.

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[38] A revised data reporting format was introduced in December 2016 to capture more granular information on fund based activities and reducing the others category. Therefore, the March 2017 data classification are not strictly comparable with the earlier period.

[39] 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 the borrowing 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.
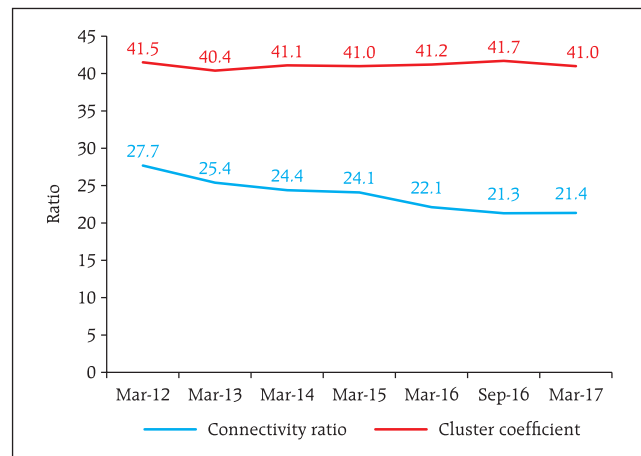
2.40   The degree of interconnectedness in the banking system, measured by the connectivity ratio[40], decreased gradually since 2012 indicating that the links/ connections between the banks have reduced over time. However, it has remained almost at the same level in the current half-year. The cluster coefficient[41] which depicts local interconnectedness remained consistent during the period from March 2012 to March 2017 indicating that the clustering/ grouping within the banking network has not changed much over time (Chart 2.27).

Chart 2.27: Connectivity Statistics of the banking system

Source: RBI supervisory returns and staff calculations.

Network of the financial system

2.41   From the perspective of larger financial system, SCBs were the dominant players accounting for nearly 51 per cent of the bilateral exposure (both payables and receivables) followed by asset management companies managing mutual funds (AMC-MFs) at around 13 per cent, NBFCs at 12 per cent, all-India financial institutions (AIFIs) at 7 per cent, insurance companies and housing finance companies (HFCs)[42] at around 8 per cent. UCBs and pension funds together accounted for nearly 1 per cent of the bilateral exposure in the financial system.

2.42   The AMC-MFs followed by the insurance companies were the biggest fund providers in the system, while the NBFCs followed by the SCBs and HFCs were the biggest receivers of funds. Within the SCBs, however, both the PVBs and the FBs had a net payable position *vis-à-vis* the entire financial sector, whereas the PSBs had a net receivable position (Chart 2.28 and Table 2.5).

Chart 2.28: Network plot of the financial system – March 2017
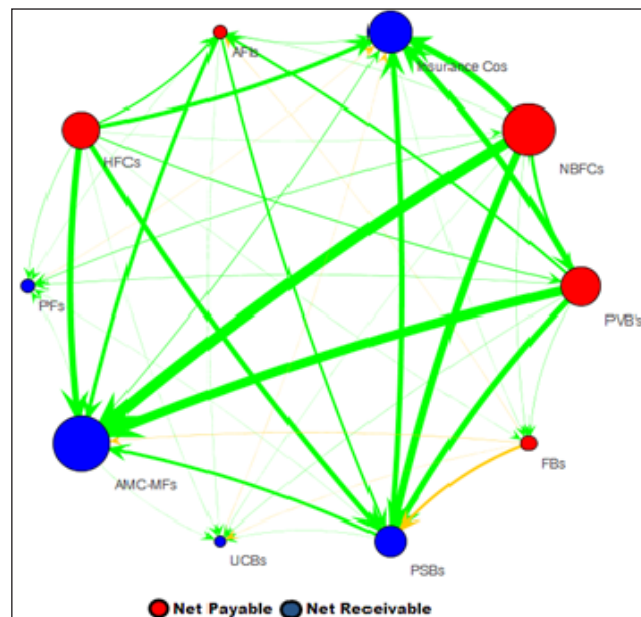
Note: Based on sample.
Source: RBI supervisory returns and staff calculations

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

[41] *Cluster Coefficient:* Clustering in networks measures how interconnected each node is. Specifically, there should 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 with high local interconnectedness prevailing in the system.

[42] HFCs have been included in the network analysis for the first time.

2.43   Among the lenders (*i.e.* those who have net receivable position against the rest of the financial system), the funds lent by AMC-MF, insurance companies and PSBs increased in March 2017 as compared to September 2016. Among the borrowers, the funds borrowed by All India FIs (*viz.* NABARD, EXIM, NHB, SIDBI) decreased, whereas, those by NBFCs, PVBs, FBs increased (Chart 2.29).

Interaction between SCBs, AMC-MFs and insurance companies[48]

2.44   At the end of March 2017, the gross receivables of AMC-MFs from the financial system was around 39 per cent of its average assets under management (AUM), while the gross receivables of the banking system was around 10.4 per cent of its total assets.

2.45   The banking sector had a gross exposure (receivable) of nearly ₹154 billion in March 2017 towards the insurance and mutual fund sectors taken together (as against ₹134 billion in September

**Table 2.5: Inter-sector assets and liabilities – March 2017**

(₹ billion)

Fin. Entity	Receivables	Payables
PSBs	6096.1	3152.1
PVB	2512.7	6584.8
FB	908.9	1396.4
AMC-MFs[43]	6942.8	485.5
Insurance companies[44]	4632.2	87.6
NBFCs[45]	377.0	6067.3
UCBs[46]	144.6	42.1
FIs (NABARD, Exim , NHB, SIDBI)	1765.3	2156.9
PFs	394.9	1.1
HFCs[47]	470.5	4271.2

Note: The receivable and payable amounts do not include transactions among entities of the same group.
Source: RBI supervisory returns and staff calculations.

Chart 2.29: Net lending (+ve) / borrowing (-ve) by the institutions
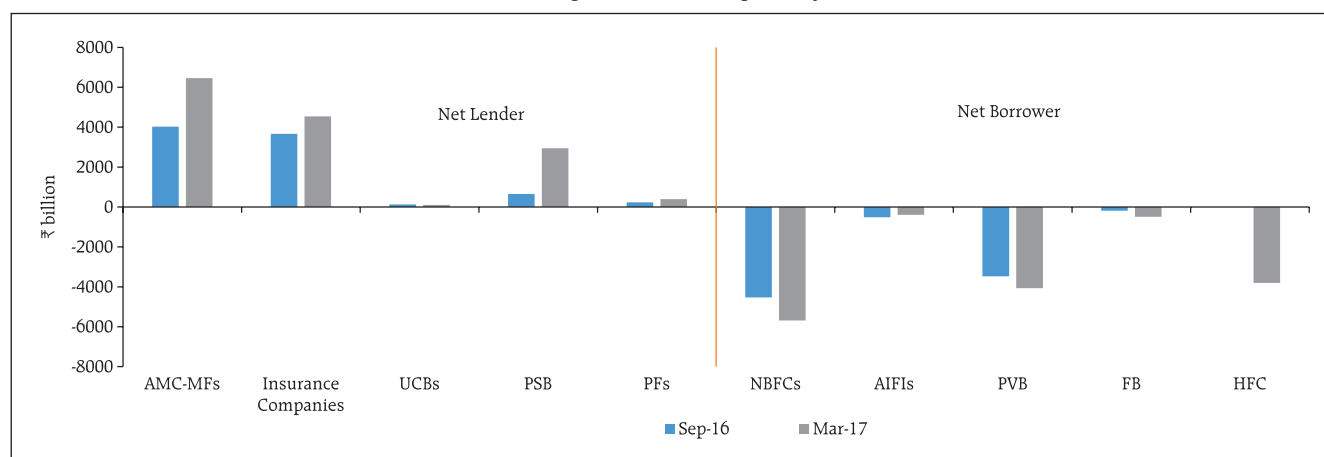
Note: HFCs have been included in the network analysis for the first time. Based on sample.
Source: RBI supervisory returns and staff calculations

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[43] The sample includes 22 AMC-MFs which covers more than 90 per cent of the AUM of the mutual fund sector.

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

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

[46] The sample includes 20 SUCBs.

[47] Sample for HFC includes 15 entities.

[48] The analysis is confined to bilateral exposure (both fund and non-fund based) among 88 SCBs and a select sample of AMC-MFs and insurance companies.

2016). At the same time, the combined exposure (gross receivable) of AMC-MFs and insurance companies towards the banking sector was nearly ₹4.8 trillion (as against ₹4.4 trillion in September 2016), which accounted for nearly 3.7 per cent of the total liabilities of the banking system in March 2017.

Exposure to NBFCs

2.46   NBFCs were the largest net receivers of funds from the financial system with SCBs accounting for 41 per cent, followed by AMC-MFs (at 35 per cent) and insurance companies (at 20 per cent). Pension funds accounted for nearly 2 per cent of the net borrowings by NBFCs from within the financial system.[49]
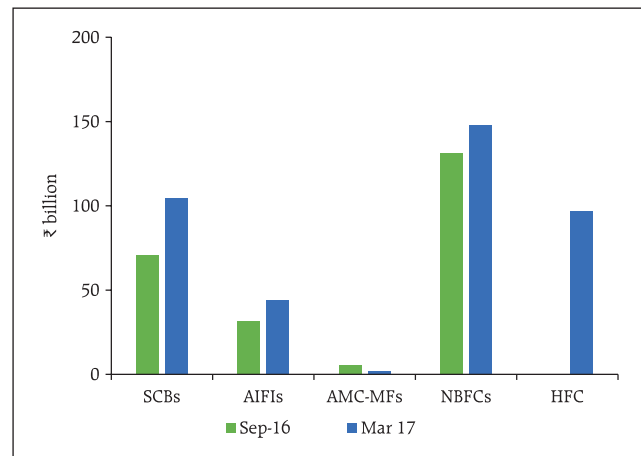
Exposure of Pension funds[50]

2.47   Pension funds were net lenders in the financial system with a gross exposure (receivable) of ₹395 billion in March 2017. Within the financial system as referred to in the analysis here, nearly 37 per cent of the exposure (gross receivables) of pension funds was to the NBFC sector followed by the banking sector (26 per cent) and HFCs (25 per cent) (Chart 2.30).[51]

Exposure to housing finance companies

2.48   HFCs were net receiver of funds from the financial system: SCBs (37 per cent) followed by AMC-MF (32 per cent) and insurance sector (20 per cent) (Chart 2.31).

Chart 2.30: Gross exposure (receivable) of pension funds

Note: 1. These exposures are not on the balance sheet of the pension funds but on the balance sheet of the NPS schemes managed by pension funds. The analysis is confined to bilateral exposure (both fund and non-fund based) among a select sample of regulated entities. Based on sample.
2. HFCs have been included in the network analysis for the first time, therefore, exposure of pension funds to HFCs for September 2016 is not available.
Source: RBI supervisory returns and staff calculations

Chart 2.31: Exposure to housing finance companies – March 2017
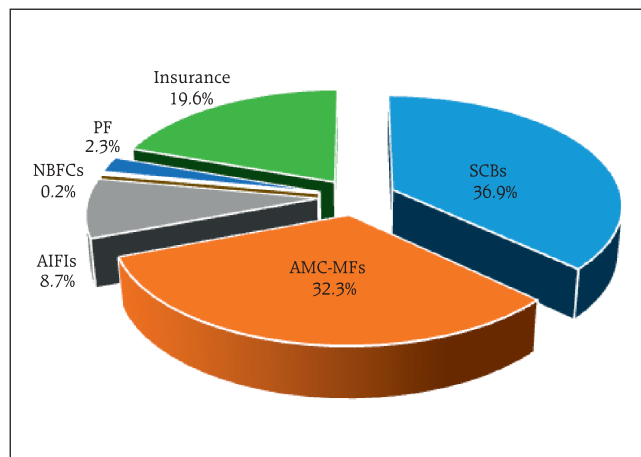
Note: Based on sample.
Source: RBI supervisory returns and staff calculations

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[49] The numbers quoted in this paragraph are confined to a select sample of NBFCs which are significant from a contagion perspective and their bilateral exposure with a sample of regulated financial institutions.

[50] The data pertains to the exposure of the schemes managed by the seven pension funds and regulated/ administered by PFRDA.

[51] Exposure of pension funds to UCBs and Insurance companies (in the selected sample) was nil.

Contagion analysis[52]

2.49   A contagion analysis using network tools is a stress test which is carried out to estimate potential losses that could happen in the event of failure[53] of one or more banks. The estimated impact under joint solvency-liquidity contagion shows that in the event of failure of trigger bank, the maximum solvency losses could be nearly 11 per cent of Tier-I capital of the banking system, while the erosion in terms of liquidity could be about 33 per cent of the total liquidity buffer of the banking system (Charts 2.32 and 2.33). Among these banks, the most connected bank may result in greater losses to the system. However, the quantum of losses due to contagion have significantly reduced for most of the banks in March 2017 as compared to September 2016 as liquidity in the system improved due to increased deposits following the withdrawal of specified bank notes (SBNs) in November 2016.

Chart 2.32: Top 10 banks with maximum contagion impact – Solvency losses – March 2017
(Joint solvency-liquidity contagion)
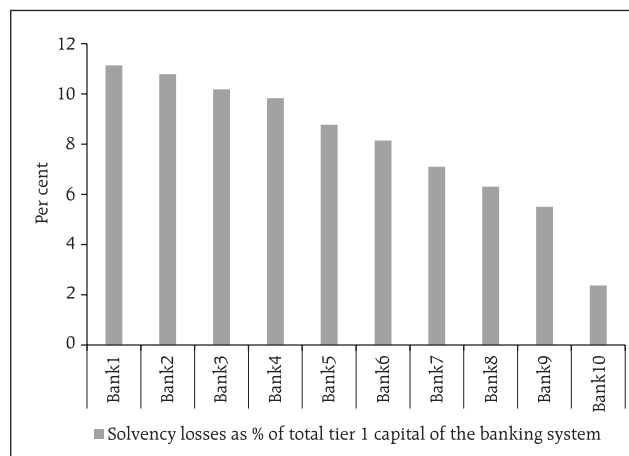
Source: RBI Supervisory returns and staff calculations.

Chart 2.33: Top 10 banks with maximum contagion impact – Liquidity losses – March 2017
(Joint solvency-liquidity contagion)
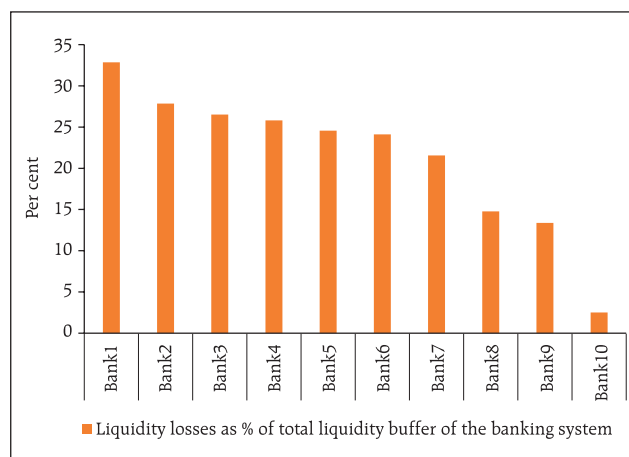
Source: RBI Supervisory returns and staff calculations.

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[52] 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 (*i.e.* joint solvency liquidity contagion) as typically a bank is net borrower *vis-a-vis* some counterparties while remaining a net lender against some others. For detailed methodology refer Annex-2

[53] Failure criteria for joint contagion analysis has been taken as Tier-1 CRAR falling below 7 per cent.