

# Financial Stability Report



Reserve Bank of India  
June 2011

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Published by the Reserve Bank of India, Mumbai 400 001 and designed and printed at Jayant Printery,  
352/54, Girgaum Road, Murlidhar Compound, Near Thakurdwar Post Office, Mumbai - 400 002.

# Contents

|                                                                                                                                                        | Page No         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>Foreword</b>                                                                                                                                        |                 |
| <b>List of Select Abbreviations</b>                                                                                                                    | <b>i to iii</b> |
| <b>Assessment and Outlook</b>                                                                                                                          | <b>1</b>        |
| <b>Chapter I : Macroeconomic Outlook</b>                                                                                                               | <b>7</b>        |
| <b>Chapter II : Financial Markets</b>                                                                                                                  | <b>15</b>       |
| <b>Chapter III : Financial Institutions</b>                                                                                                            | <b>28</b>       |
| <b>Chapter IV : Financial Sector Policies and Infrastructure</b>                                                                                       | <b>51</b>       |
| <b>Chapter V : Macrofinancial Stress Testing</b>                                                                                                       | <b>70</b>       |
| <br>                                                                                                                                                   |                 |
| <b>ANNEX</b>                                                                                                                                           |                 |
| Stress Testing Methodologies                                                                                                                           | 80              |
| <br>                                                                                                                                                   |                 |
| <b>LIST OF BOXES</b>                                                                                                                                   |                 |
| 2.1 Algorithm trading / High Frequency Trading                                                                                                         | 26              |
| 3.1 Are We Witnessing a Credit Boom?                                                                                                                   | 32              |
| 3.2 Provision for Pension and Gratuity Liabilities Arising Out of Wage Revision in Public Sector Banks and Old Private Sector Banks: Systemic Concerns | 43              |
| 3.3 Systemic Risks Posed by the Insurance Sector                                                                                                       | 48              |
| 4.1 Capital Buffers Proposals Under Basel III                                                                                                          | 53              |
| 4.2 The Bank Subsidiary Model and the Financial Holding Company Model                                                                                  | 57              |
| 4.3 Main Features of the Proposed Amendments to Banking Legislations                                                                                   | 59              |
| 4.4 Network Analysis of the Indian Interbank Market – Analytics and Methodology                                                                        | 63              |
| 5.1 CIMDO-Approach                                                                                                                                     | 71              |
| <br>                                                                                                                                                   |                 |
| <b>LIST OF CHARTS</b>                                                                                                                                  |                 |
| 1.1 Macroeconomic Risk Map                                                                                                                             | 7               |
| 1.2 Deceleration of Growth in 2011                                                                                                                     | 8               |
| 1.3 PMI in Europe and the U.S.                                                                                                                         | 8               |
| 1.4 Unemployment Rate                                                                                                                                  | 8               |
| 1.5 Global Imbalances                                                                                                                                  | 9               |
| 1.6 Government Balance and Debt                                                                                                                        | 9               |
| 1.7 Contribution to Growth – Supply Side                                                                                                               | 10              |

|                                                                                                                                                          | <b>Page No</b> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 1.8 Industrial and Capital Goods Production                                                                                                              | 10             |
| 1.9 Contribution to Growth – Demand Side                                                                                                                 | 10             |
| 1.10 Global Commodity Price Indices                                                                                                                      | 11             |
| 1.11 Housing Prices and Housing Credit                                                                                                                   | 12             |
| 1.12 Gold Prices Continue to Rise                                                                                                                        | 12             |
| 1.13 Oil Trade and Price and CAD                                                                                                                         | 12             |
| 1.14 Net FDI and Portfolio Flows                                                                                                                         | 13             |
| 1.15 Deficit and Debt (Centre and States)                                                                                                                | 13             |
| 1.16 Corporate Sector Performance                                                                                                                        | 13             |
| 1.17 Household Consumption and Borrowing                                                                                                                 | 14             |
| 1.18 Impairment in Retail Assets                                                                                                                         | 14             |
| 1.19 Impairment of Housing Assets                                                                                                                        | 14             |
| 2.1 10-year Bond Yields (in per cent)                                                                                                                    | 15             |
| 2.2 US dollar Against Advanced (DXY) and Emerging Asian Currencies (ADXY)                                                                                | 15             |
| 2.3 Federal Funds Implied Probability of Target Rate in Federal Open Markets Committee Meeting in December 2011 Based on Federal Funds Futures Contracts | 16             |
| 2.4 Stock Indices (normalised, July 1, 2010 = 100)                                                                                                       | 16             |
| 2.5 US\$/JPY Spot Rate and 1 Month Volatilities (in per cent)                                                                                            | 17             |
| 2.6 European Sovereign CDS in 5-year Maturity (in basis points)                                                                                          | 17             |
| 2.7 Near Month Energy Futures Prices (in US\$)                                                                                                           | 18             |
| 2.8 OPEC Capacity Versus Actual Production and OPEC Quota (In 000s barrels per day)                                                                      | 18             |
| 2.9 Commodity Price Movements (normalised, 02 July 2010 = 100)                                                                                           | 19             |
| 2.10 30 – Day Rolling Correlation of Reuters – Jeffries CRB Index with Various Assets                                                                    | 19             |
| 2.11 Factors Affecting Banking System's Liquidity                                                                                                        | 19             |
| 2.12 Money Market Rates in India (in per cent)                                                                                                           | 20             |
| 2.13 Indian Sovereign Yield Curve Shapes                                                                                                                 | 20             |
| 2.14 WPI Inflation Forecasts and Actuals, and RBI Repo Rate (in per cent)                                                                                | 20             |
| 2.15 Bond Market Yields in 10-year Maturity (in per cent)                                                                                                | 21             |
| 2.16 FII Equity and Debt Daily Net Flows (US\$ million) and Exchange Rate of Rupee                                                                       | 21             |
| 2.17 Trend in ECBs and FCCBs and Interest Rate Differentials in 10-years                                                                                 | 22             |
| 2.18 India's International Investment Position (in US\$ billion)                                                                                         | 23             |
| 2.19 25 Delta Risk Reversals in the 6 Month Maturity for US\$/INR and US\$/CNY (in per cent)                                                             | 23             |
| 2.20 Redemption Profile of FCCBs (in US\$ million)                                                                                                       | 24             |
| 2.21 FII Gross Monthly Purchases and Sales in Equity Markets (in ₹ crore)                                                                                | 25             |

|                                                                                            | <b>Page No</b> |
|--------------------------------------------------------------------------------------------|----------------|
| 2.22 FII Gross Monthly Purchases and Sales in Debt Markets (in ₹ crore)                    | 25             |
| 2.23 Financial Stress Indicator (with Projections upto August 2011 in Green)               | 26             |
| 3.1 Sovereign Funding Requirements                                                         | 29             |
| 3.2 Banking Funding Needs                                                                  | 29             |
| 3.3 Growth in Select Balance Sheet Components                                              | 29             |
| 3.4 Share of CDs and Borrowings in Liabilities                                             | 30             |
| 3.5 Level of Liquid Assets                                                                 | 30             |
| 3.6 Maturity Profile of the Deposits and Advances                                          | 30             |
| 3.7 Ratio of CDs and Borrowings and CASA Deposits to Total Deposits                        | 30             |
| 3.8 Growth of Credit and NPAs during Phases of Upturn and Downturn                         | 31             |
| 3.9 Growth in Credit, NPAs and Tier-I Capital Funds vis-a-vis their Growth Trend           | 32             |
| 3.10 Credit Growth <i>vis-à-vis</i> its Long Term Trend                                    | 32             |
| 3.11 Share of Loans to Commercial Real Estate, Retail and Infrastructure in Gross Credit   | 33             |
| 3.12 Growth of Combined Exposure (Retail, Commercial Real Estate and Infrastructure Loans) | 33             |
| 3.13 Growth in Real Estate Loans                                                           | 33             |
| 3.14 Share of Real Estate Loans in Gross Credit                                            | 34             |
| 3.15 Real Estate NPA Ratios                                                                | 34             |
| 3.16 Share of Retail Loans and its NPAs in Gross Advances and Gross NPAs                   | 34             |
| 3.17 Growth in Housing and Personal Loans                                                  | 35             |
| 3.18 Growth in Retail Loan NPAs                                                            | 35             |
| 3.19 Ratio of Retail Loan NPAs                                                             | 35             |
| 3.20 Growth of Infrastructure Loans and its NPAs                                           | 35             |
| 3.21 Share of Important Infrastructure Segments in Total Infrastructure Credit             | 36             |
| 3.22 Growth in Infrastructure Segments                                                     | 36             |
| 3.23 Ratio of NPAs in Banks' Exposure to Infrastructure Sector                             | 36             |
| 3.24 Risk Wise Distribution of Bank Credit to Industries                                   | 37             |
| 3.25 Bank Groups' Exposure to High Risk Industries                                         | 37             |
| 3.26 Growth in the Outstanding Exposure and NPAs in Priority Sectors                       | 37             |
| 3.27 Growth in OBS Exposures Among Bank Groups                                             | 38             |
| 3.28 Distribution of OBS Exposure                                                          | 38             |
| 3.29 Composition of OBS' Constituents                                                      | 38             |
| 3.30 Capital Adequacy Ratios of the Banks' Groups                                          | 39             |
| 3.31 Leverage Ratio of Bank Groups                                                         | 39             |
| 3.32 Gross and Net NPA Ratios                                                              | 40             |

|                                                                                              | <b>Page No</b> |
|----------------------------------------------------------------------------------------------|----------------|
| 3.33 Growth of Advances and NPAs                                                             | 40             |
| 3.34 Slippage Ratio Over the Years                                                           | 40             |
| 3.35 Category Wise NPAs                                                                      | 41             |
| 3.36 Provisioning Coverage Ratios (PCR) of Bank Groups                                       | 41             |
| 3.37 Income and Expense Components as Proportion of Total Income and Expense                 | 41             |
| 3.38 Growth of Select Components of Income and Expense                                       | 42             |
| 3.39 Share of Profit from Trading in Investments and Staff Expenses in Other Income/Expenses | 42             |
| 3.40 Profitability Ratios                                                                    | 44             |
| 3.41 Banking Stability Map                                                                   | 45             |
| 3.42 Banking Stability Indicator                                                             | 45             |
| 3.43 Gross NPA Ratio of Co-operative Banking Sector                                          | 46             |
| 3.44 Select Financial Performance Indicators of Scheduled UCBs                               | 46             |
| 3.45 Borrowings of NBFCs ND SIs                                                              | 47             |
| 3.46 Financial Soundness Indicators of NBFCs ND SIs                                          | 47             |
| 3.47 Financial Soundness indicators of NBFC-Ds                                               | 47             |
| 4.1 CRAR Projections (2012)                                                                  | 52             |
| 4.2 CRAR Projections (2013)                                                                  | 52             |
| 4.3 Ratio of Credit to GDP                                                                   | 54             |
| 4.4 Ratio of Credit to GDP(Seasonally Adjusted)                                              | 54             |
| 4.5 Real GDP Growth                                                                          | 54             |
| 4.6 Interest Income to Total Assets                                                          | 54             |
| 4.7 Profit Before Tax to Assets                                                              | 55             |
| 4.8 Price to Earnings (PE) Ratio                                                             | 55             |
| 4.9 Increase in Risk Weighted Assets Based on Transitional and Stressed Ratings              | 56             |
| 4.10 Bipartite Representation of Bank Lending in Four Banking Groups                         | 61             |
| 4.11 Net Bilateral Exposures of All Banks                                                    | 61             |
| 4.12 Net Bilateral Exposure of Top 20 Banks                                                  | 61             |
| 4.13 Impact of Failure of One Trigger Bank                                                   | 62             |
| 4.14 Impact of Failure of Two Trigger Banks                                                  | 62             |
| 4.15 Impact of the Failure of Top 20 Banks (one at a time)                                   | 63             |
| 4.16 Impact of the Failure of Ten Pairs of Trigger Banks (one pair at a time)                | 63             |
| 4.17 Trends in Volume                                                                        | 64             |
| 4.18 Trends in Value                                                                         | 64             |
| 4.19 Cross-system Linkages in the Indian Scenario                                            | 67             |

|                                                                                                                       | <b>Page No</b> |
|-----------------------------------------------------------------------------------------------------------------------|----------------|
| 4.20 Common Participants in Various Payments and Settlements Systems                                                  | 67             |
| 5.1 JPOD and BSI                                                                                                      | 72             |
| 5.2 Individual PoDs and JPoDs : Percentage Changes                                                                    | 72             |
| 5.3 Toxicity Index: Bank-wise                                                                                         | 72             |
| 5.4 Vulnerability Index : Bank-wise                                                                                   | 73             |
| 5.5 Cascade Effects : Bank-wise                                                                                       | 73             |
| 5.6 Simulation of Stress Conditions: Change in Density of Aggregate Risk Indicator -<br>Return on Assets – March 2011 | 74             |
| 5.7 Duration of Equity - Trend (Commercial Banks)                                                                     | 74             |
| 5.8 Duration of Equity – Frequency Distribution<br>(Scenario I - Savings Deposits Withdrawal within 1 month)          | 75             |
| 5.9 Duration of Equity - Frequency Distribution<br>(Scenario II - Savings Deposits Withdrawal in 3 - 6 Months)        | 75             |
| 5.10 Liquidity Position of Banks : March 2010 Baseline and Stressed Scenario                                          | 75             |
| 5.11 Liquidity Position of Banks: March 2011 Baseline and Stressed Scenario                                           | 75             |
| 5.12 Liquidity Sustainability Ratio: March 2011                                                                       | 76             |
| 5.13 Non-Performing Advances under Stress Scenarios                                                                   | 76             |
| 5.14 Banks Capital Adequacy Ratios : Translated from NPAs Under Stress Scenarios                                      | 76             |
| 5.15 Movement of Accumulated Impulse Response                                                                         | 77             |
| 5.16 Stress Testing Scheduled UCBs: Impact of Shocks on Capital Position                                              | 78             |

#### **LIST OF TABLES**

|                                                                                                                             |    |
|-----------------------------------------------------------------------------------------------------------------------------|----|
| 2.1 ECBs Registered with the Reserve Bank (in US\$ million)                                                                 | 22 |
| 2.2 VAR Granger Causality                                                                                                   | 22 |
| 2.3 Parameter Estimates                                                                                                     | 22 |
| 2.4 Lenders' Profile of ECBs (in US\$ million)                                                                              | 23 |
| 2.5 Autocorrelation coefficients at the First and Second Lag Level for Daily Net FII Flows in<br>Equity and Debt into India | 24 |
| 3.1 Distribution of SCBs' CRAR and Core CRAR                                                                                | 39 |
| 3.2 Indicators Used for Construction of Banking Stability Map and Banking Stability Indicator                               | 44 |
| 5.1 Stress Test on Projected Balance Sheet                                                                                  | 74 |
| 5.2 Baseline Projections                                                                                                    | 76 |
| 5.3 Stress Scenarios                                                                                                        | 76 |
| 5.4 Non Performing Advances Ratio Under Stress Conditions                                                                   | 77 |





## Foreword

The distinctly different conditions in advanced and emerging market economies pose significant risks for the global financial system. Recovery in advanced economies continues to be tenuous even as inflation concerns emerge. In the US, QE2 is scheduled to end by June 2011, and there is uncertainty about the post-QE2 scenario. The European Central Bank raised its main interest rate, for the first time since July 2008, in April 2011 in a move aimed at combating incipient inflation signals across the Eurozone. Heightened sovereign risk concerns, particularly in the Euro region, and fears of adverse fallout on the financial sector further cloud the sentiments. For the emerging economies, on the other hand, inflation is emerging as a key concern amidst strong domestic demand, rapid credit growth and large capital inflows.

India was one of the earliest movers in tightening the monetary policy to address inflationary pressures. A shift from absorption mode to injection mode since March 2010 has seen an effective rise in policy rates by 400 basis points. Bank lending rates firmed up responding to monetary policy signals as banks progressively passed on the increased costs. Global commodity prices, particularly oil, and performance of the monsoon are the key risk factors to inflation management in the months ahead. A slight moderation in growth is projected for the current year. Pressures on the expenditure side in the form of higher subsidy bill may pose further challenges for fiscal management.

Though the current account deficit for 2010-11 is expected to be around 2.5 per cent, a few external sector indicators suggest some deterioration. While FDI flows have been muted, net FII flows remain strong and ECB flows have seen a significant rebound. Consequently, un-hedged positions of corporates accessing foreign currency funding need to be monitored both by the banks from the credit risk angle and by the systemic regulator from a stability perspective.

The Indian financial sector has remained stable. Banks are well capitalised; the Reserve Bank continues to be vigilant and has taken certain prudential as well as macro-prudential measures in order to enhance the soundness of the banking system. While the focus of regulating the non-banking space continues to be on leverage and systemic interconnectedness, a comprehensive review is underway to revisit certain broad principles that underpin the regulatory architecture keeping in view the economic role and heterogeneity of this sector and the recent international experience.

The two-tier institutional arrangement in the shape of Financial Stability Development Council (FSDC) and its Sub-Committee, for monitoring financial stability on an ongoing basis has been operationalised. Both the main FSDC and its Sub-Committee have so far held two meetings each. Apart from making an assessment of the developments in financial markets and the financial system, the deliberations have focused *inter alia* on strengthening the financial conglomerates monitoring framework, addressing regulatory gaps and inter-regulatory issues related to systemic risk.

Within the Reserve Bank, a number of initiatives have been taken to improve the financial stability analytics to take full account of the different sources of systemic risk. Though systemic risk measurement is in its early stages of evolution, an effort has been made to identify, monitor and address systemic linkages through network analysis model and analyse soft spots in the system using banking stability measures. Reflecting deepening inter-regulatory collaborative process for financial stability, this FSR carries significant contributions from the Securities and Exchange Board of India (SEBI) and the Insurance Development Regulatory Authority (IRDA) on systemic issues pertaining to the respective segments.

Ensuring financial stability cannot be a formulaic rule-based task. The endeavour for the policy makers should be to not get trapped in "commoditised ideas, reductive categories and prepackaged narratives" – trying to fit everything to 'The Bed of Procrustes'<sup>1</sup>.

Mumbai  
June 14, 2011

D. Subbarao  
Governor

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<sup>1</sup> Talib, Nassim: "The Bed of Procrustes", 2010, Random House



## List of Select Abbreviations

|        |                                                                    |       |                                                          |
|--------|--------------------------------------------------------------------|-------|----------------------------------------------------------|
| ADF    | Augmented Dickey Fuller                                            | CP    | Commercial Paper                                         |
| ADXY   | Bloomberg - J P Morgan Asia Dollar Index                           | CRAR  | Capital to Risk-weighted Assets Ratio                    |
| AEs    | Advanced Economies                                                 | CRR   | Cash Reserve Ratio                                       |
| ALM    | Asset Liability Management                                         | CSO   | Central Statistical Organisation                         |
| ARCH   | Auto Regressive Conditional<br>Heteroskedasticity                  | DCCB  | District Central Cooperative Bank                        |
| ARIMA  | Auto Regressive Integrated Moving<br>Average                       | DICGC | Deposit Insurance and Credit Guarantee<br>Corporation    |
| BCBS   | Basel Committee on Banking Supervision                             | DiDe  | Distress Dependence                                      |
| BIS    | Bank for International Settlements                                 | DJIA  | Dow Jones Industrial Average                             |
| BoE    | Bank of England                                                    | DoE   | Duration of Equity                                       |
| BoJ    | Bank of Japan                                                      | DRS   | Department of Registration and Stamps                    |
| BSE    | Bombay Stock Exchange                                              | DvP   | Delivery versus Payment                                  |
| BSI    | Banking Stability Index                                            | DXY   | US Dollar Index                                          |
| BSM    | Bank Subsidiary Model                                              | EAD   | Exposure At Default                                      |
| BSMD   | Banking System's Portfolio Multivariate<br>Density                 | ECB   | External Commercial Borrowing /<br>European Central Bank |
| CAD    | Current Account Deficit                                            | ECN   | Electronic Communication Network                         |
| CAMELS | Capital, Asset quality, Management,<br>Earning, Liquidity, Systems | ECS   | Electronic Clearing System                               |
| CASA   | Current Account Savings Account                                    | EM    | Emerging Market                                          |
| CBLO   | Collateralised Borrowing and Lending<br>Obligation                 | EMDE  | Emerging Market and Developing<br>Economy                |
| CBRC   | China Banking Regulatory Commission                                | EME   | Emerging Market Economy                                  |
| CBS    | Core Banking Solution                                              | FC    | Financial Conglomerate                                   |
| CCA    | Contingent Claims Analysis                                         | FCCB  | Foreign Currency Convertible Bond                        |
| CCIL   | Clearing Corporation of India Limited                              | FDI   | Foreign Direct Investment                                |
| CCP    | Central Counterparty                                               | FI    | Financial Institution                                    |
| CD     | Certificate of Deposit                                             | FII   | Foreign Institutional Investor                           |
| CDS    | Credit Default Swap                                                | FMC   | Forward Markets Commission                               |
| CIMDO  | Consistent Information Multivariate<br>Density Optimising          | FOMC  | Federal Open Market Committee                            |
| CLI    | Composite Leading Indicators                                       | FSDC  | Financial Stability and Development<br>Council           |
|        |                                                                    | FSMD  | Financial System's Portfolio Multivariate<br>Density     |

List of Select Abbreviations

|         |                                                                   |            |                                                            |
|---------|-------------------------------------------------------------------|------------|------------------------------------------------------------|
| FSI     | Financial Stress Indicator                                        | MTM        | Mark-to-Market                                             |
| FSLRC   | Financial Sector Legislative Reforms Commission                   | NBFC       | Non-Banking Financial Company                              |
| FSR     | Financial Stability Report                                        | NBFC-D     | Deposit taking NBFC                                        |
| GARCH   | Generalised Auto Regressive Conditional Heteroskedasticity        | NBFC-ND-SI | Non-Deposit taking-Systemically Important NBFC             |
| GDP     | Gross Domestic Product                                            | NBFC-SI    | Systemically Important NBFC                                |
| GFSR    | Global Financial Stability Report                                 | NCD        | Non-Convertible Debentures                                 |
| HCM     | Holding Company Model                                             | NEFT       | National Electronic Fund Transfer                          |
| HFT     | Held for Trading /High Frequency Trading                          | NHB        | National Housing Bank                                      |
| IBA     | Indian Bank's Association                                         | NOC        | No Objection Certificate                                   |
| ICAI    | Institute of Chartered Accountants of India                       | NPA        | Non-Performing Asset/Advances                              |
| ICT     | Integrated Communication Technology                               | NRI        | Non-Resident Indian                                        |
| IDRBT   | Institute for Development and Research in Banking Technology      | NSE        | National Stock Exchange                                    |
| IFRS    | International Financial Reporting Standards                       | OBS        | Off-Balance Sheet                                          |
| IIF     | Institute of International Finance                                | OECD       | Organisation for Economic Co-operation and Development     |
| IIP     | Index of Industrial Production/ International Investment Position | OMO        | Open Market Operations                                     |
| IMF     | International Monetary Fund                                       | OTC        | Over the Counter                                           |
| INFINET | Indian Financial Network                                          | P/E        | Price to Earnings Ratio                                    |
| INR     | Indian Rupee                                                      | PCARDB     | Primary Cooperative Agriculture and Rural Development Bank |
| IRDA    | Insurance Regulatory and Development Authority                    | PCE        | Probability of Cascade Effect                              |
| IRF     | Interest Rate Futures                                             | PCR        | Provision Coverage Ratio                                   |
| JPoD    | Joint Probability of Distress                                     | PIO        | Persons of Indian Origin                                   |
| LAF     | Liquidity Adjustment Facility                                     | PIS        | Portfolio Investment Scheme                                |
| LEI     | Long-term Economic Impact                                         | PMI        | Purchase Manager Indices                                   |
| LSR     | Liquidity Sustainability Ratio                                    | PMS        | Portfolio Management Services                              |
| MAG     | Macroeconomic Assessment Group                                    | PoD        | Probability of Distress                                    |
| MENA    | Middle East and North Africa                                      | PSB        | Public Sector Bank                                         |
| MF      | Mutual Fund                                                       | PSS        | Payment and Settlement Systems                             |
| MFI     | Micro-Finance Institution                                         | QE         | Quantitative Easing                                        |
| MoU     | Memorandum of Understanding                                       | REER       | Real Effective Exchange Rate                               |
| MSE     | Micro and Small Enterprises                                       | RoA        | Return on Assets                                           |
|         |                                                                   | RoE        | Return on Equity                                           |
|         |                                                                   | RRB        | Regional Rural Bank                                        |
|         |                                                                   | RTGS       | Real Time Gross Settlement                                 |

|        |                                                          |       |                                   |
|--------|----------------------------------------------------------|-------|-----------------------------------|
| RWA    | Risk-Weighted Assets                                     | SOR   | Smart Order Routing               |
| S&P    | Standard and Poor                                        | StCB  | State Cooperative Bank            |
| SCARDB | State Cooperative Agriculture and Rural Development Bank | SUCB  | Scheduled Urban Co-operative Bank |
| SCB    | Scheduled Commercial Bank                                | UCB   | Urban Co-operative Bank           |
| SEBI   | Securities and Exchange Board of India                   | VaR   | Value at Risk                     |
| SI     | Systemically Important                                   | VAR   | Vector Autoregression             |
| SIFI   | Systemically Important Financial Institution             | VI    | Vulnerability Index               |
| SLR    | Statutory Liquidity Ratio                                | VIX   | Volatility Index                  |
| SLRI   | Systemic Liquidity Risk Index                            | WEO   | World Economic Outlook            |
| SME    | Small and Medium Enterprise                              | WPI   | Wholesale Price Index             |
|        |                                                          | Y-o-Y | Year-on-Year                      |



## Assessment and Outlook

*The Indian financial system remains stable in the face of some fragilities being observed in the global macro-financial environment. The growth is slackening in most parts of the world, even as the risks from global imbalances and sovereign debt crisis in Europe continue to hover. The uncertainties in global environment with persistently high energy and commodity prices have contributed to a slight moderation in India's growth momentum as well. The macroeconomic fundamentals for India, however, continue to stay strong, notwithstanding the prevailing inflationary pressures and concerns on fiscal front.*

*During the period since the previous Financial Stability Report (FSR) was published in December 2010, Indian financial markets have remained stress free even as the reliance of domestic firms on international sources of finance denominated in foreign currency has been growing. The regulatory arrangements are being strengthened, emphasising a coordinated approach, in line with the current international developments and best practices.*

*The banking sector continues to be stable, though the structure of the sector - characterised by significantly 'connected' and 'clustered' banks, carries certain inherent risks, as shown by the Network Analysis- one of the newly introduced analytical techniques in this FSR. The Banking Stability Indicator endorses the overall improvement in the stability of banking sector, even though the robust growth in bank credit during 2010-11, is hinting at some early concerns on profitability and asset quality. The various macro-financial stress tests, including the newly introduced ones based on more rigorous computation methodologies; also show that the banking sector remains adequately capitalised and resilient to asset quality shocks and other plausible adverse changes in macroeconomic scenario.*

### Global Macroeconomic Developments

#### ***Slowdown in growth even as the risk scenario improves...but global imbalances remain***

1. The global risk scenario has improved during the last six months, though there are signs of a slowdown in growth during 2011 in most countries, including some of the developing economies in Asia. The main factors affecting the global growth are: high food, commodity and energy prices, steps towards fiscal consolidation, sovereign debt problems in the Euro area and high level of government debt in some advanced economies. Also, the main underlying factors behind global imbalances remain largely unaddressed, increasing the uncertainty around the path of global recovery.

#### ***Sovereign debt crisis threatening to spill over to other areas***

2. The sovereign debt crisis in countries like Greece, Portugal, and Ireland is posing serious challenges for the stability in the entire Euro area. The increasingly high levels of government debt in other advanced countries are also adding to the uncertainty around the fiscal consolidation and its impact on international

financial markets. Although the Emerging Market Economies (EMEs) have more comfortable fiscal space and better growth prospects, there are still significant risks on the fiscal front, given the complex inter-play between growth and inflation.

### Domestic Macroeconomic Developments

#### ***Slight fall in growth rate as management of fiscal position and inflation takes precedence***

3. The slackening of global recovery, high oil and commodity prices, deceleration in domestic industrial growth, uncertainty about continuation of strong growth in agricultural sector and impact of monetary policy actions pose downside risks to India's Gross Domestic Product (GDP) growth during 2011-12. The slowdown in growth momentum may affect the quality of the assets of financial sector.

#### ***Inflation remains a big challenge, as asset prices stay high***

4. The international prices of food, energy and commodities are expected to remain high during 2011-12. Although there has been some decline recently in

international oil prices, this may not help in inflation management as complete pass-through of previous escalations is still to be affected. Inflation is likely to face upward pressure from higher subsidy expenditure of the government and rise in wages and raw material prices. Housing prices have undergone some correction but continue to stay firm. Gold prices continue to increase on the back of strong demand.

***Current Account Deficit (CAD) may remain under pressure***

5. Recent growth in India's exports may off-set, at least partially, the expected increase in the import bill due to elevated oil and commodity prices. There does not seem to be an impending pressure on the financing of CAD. However, going ahead, as the advanced economies exit from the accommodative monetary policy, there could be some slow down in capital inflows.

***Quality and pace of fiscal consolidation remains a concern***

6. In the wake of high international commodity and oil prices, the budgetary projections of deficits for 2011-12 are expected to come under pressure. Management of government expenditure, especially subsidies bill, will pose challenges to the process of fiscal consolidation. This could be further accentuated by a tempered growth adversely impacting the revenue collections.

**Financial Markets**

***Improvement in stability of financial markets at global and domestic levels***

7. During the last six months, global financial markets have been resilient, overcoming a short phase of heightened volatility caused by the earthquake in Japan and political tensions in Libya and other parts of the Middle East and North Africa (MENA). The forecasted value for Financial Stress Indicator (FSI) for India, a measure to capture the severity of contemporaneous developments as they occur in different market segments and the banking sector, suggests benign conditions in the near term.

***Sovereign debt crisis could affect institutions and markets***

8. The sovereign debt crisis is threatening to affect some of the bigger economies even as the high deficit and debt levels in Advanced Economies (AEs) like US,

UK and Japan could exert further pressure on their sovereign rating outlook. The low economic growth combined with the high levels of debt in these countries is adversely impacting market sentiments. Continued concerns regarding sovereign risk could raise the funding costs of the financial sector and have a negative impact on its balance sheet. Evolving regulatory changes will require financial institutions to raise fresh capital even as they face a wall of refinancing at a time when sovereigns in AEs also have high borrowing programs.

***Increasing financialisation of commodity markets adding to asset correlation***

9. The sustained demand and growth in EMEs are providing strong impetus to commodity prices but the increasing financialisation of commodity markets might be adding to the volatility in commodity prices. It could also result in an increased correlation between financial and commodity markets, thereby facilitating faster transmission of shocks across markets.

***Domestic markets functioned without any stress, with liquidity conditions remaining tight for the banking system***

10. In spite of a sharp turnaround in Government cash balances with the Reserve Bank during the current financial year, liquidity in the system remained in a deficit mode reflecting an increase in liquidity requirements of the economy. The increase is mainly attributable to strong credit demand and high level of currency in circulation. However, the overnight call rates have remained range-bound. The collateralized markets continued to remain the predominant money market segment of the money market. The government bond yields hardened across all maturities. The increase was more pronounced in the short end resulting in a flattening of the yield curve. Rupee has remained range-bound, reflecting a relatively balanced external account and the general weakness experienced by the US dollar during the period.

***Increased reliance by Indian firms on foreign funding causing currency mismatches...***

11. Availability of alternative channels of funding has reduced the dependence of firms on domestic bank credit over the years. Rising domestic yields are widening the interest rate differentials vis-à-vis AEs, resulting in



a greater access to External Commercial Borrowings (ECB) by Indian firms. This trend is causing a build-up of currency mismatches in their balance sheets. India's International Investment Position (IIP) statistics show that the currency risk exposure of India's non-official sector has increased in the last few years, with an increasing net liability position. This means that the translation risk for the non-official sector arises from a depreciation of the Indian rupee.

***...even as refunding risks of corporates escalate due to maturing FCCBs***

12. During the period from 2005 to 2008, large amounts were raised through Foreign Currency Convertible Bonds (FCCBs) by many Indian companies with elevated conversion premia. Most of them are nearing maturity by March 2013. Estimates show that a very large proportion of these FCCBs may not get converted into equity thus requiring their refinancing at the much higher interest rates prevalent today.

***Portfolio capital flows – evidence of herd behaviour***

13. During 2010, Indian capital markets received a significant amount of net portfolio capital flows. These flows tend to be more volatile, though their impact on the domestic macroeconomic situation so far has been limited. While equity markets in India have undergone some downward correction with Foreign Institutional Investors (FIIs) pulling money out, the bond markets have seen incremental flows on account of attractive yields and the recent enhancement of limits for FII investment in corporate and government bonds. An internal study points to tendency of the portfolio capital flows to be 'auto-correlated' thus implying 'herd behaviour', both in good times as well as during times of stress.

***Program trading systems in Indian stock markets***

14. Encouraging the use of Algorithmic trading and High Frequency Trading (HFT) adds to the efficiency and liquidity of markets but carries some risks too. Indian securities markets have withstood systemic events in the past, without any major disruption. Even as facilities like Smart Order Routing (SOR) are introduced in Indian stock exchanges, events like 'flash crashes' witnessed in US equity markets in May 2010, need to be guarded against.

**Financial Institutions**

***Banking sector maintains good health with robust credit growth hinting towards subtle vulnerabilities***

15. The recovery in economic growth during 2010-11 has been accompanied by a strong credit growth and slight decline in Non Performing Assets (NPAs). The banking sector balance sheet increased by 19 per cent during the year ended March 31, 2011, spurred by a robust growth of 22.6 per cent in credit off take. The growth in deposit mobilisation, at around 18 per cent did not keep pace with the growth in credit, the gap being funded through an increasing share of market borrowings. This increased reliance on borrowed funds raised concerns about the liquidity position of banks arising from growing maturity mismatches, in conjunction with a reduction in the share of liquid assets in total assets.

***Asset quality, though improved, is a concern due to skewed growth in credit to certain sectors***

16. Asset quality improved mainly on the back of the credit growth which outpaced the growth in NPAs. The write-offs of NPAs by banks to cleanse their balance sheets also helped in achieving a lower gross NPA ratio. Even with a broadly diversified credit portfolio, the contribution to the credit growth was disproportionately high for three sectors – retail, commercial real estate and infrastructure. As each of these sectors have a peculiar set of asset quality propositions, the brisk growth in exposure seen during 2010-11 poses some concerns. The asset quality under the priority sector lending, especially agriculture, deteriorated at a faster rate as compared to the overall asset quality, which was a concern.

***Banks remain well capitalised, despite a marginal decline in the Capital to Risk-Weighted Assets Ratio (CRAR)***

17. The system level CRAR under Basel-II norms stood at 14.3 per cent as at end March 2011 which was well above the regulatory minimum of 9 per cent. There was, however, a slight decline over the CRAR of 14.5 per cent as at end March 2010, largely due to robust credit off take. All the bank groups had CRAR above 12 per cent as at end March 2011 under Basel-II norms.

***Profitability helped by robust Net Interest Income (NII)***

18. An increase in NII facilitated growth of around 20 per cent in aggregate net profit of the banking system, even with an almost stagnant non-interest income and increase in risk provisions. The public sector banks registered a lower growth in profits – mainly due to reduction in trading profits, increase in provisions towards staff expenses (including those for pension liabilities) and towards impaired assets. Going ahead, with hardening interest rates and the imminent increase in cost of funds, the credit growth is expected to slow down, which could adversely affect the profitability. The hike in savings account interest rate, amortizations of pension liabilities and potentially enhanced provisioning requirements for NPAs may also impact profitability.

***Further escalations in Off-Balance Sheet exposures of foreign banks***

19. The previous FSR pointed to high levels of activity/involvement of foreign banks in the use of derivatives. This trend continued during the year. Credit equivalent of the derivative exposures remained low and showed a declining trend even as the notional amounts of such exposures rose as a proportion of balance sheet size. The derivative deals, mainly the (Over the Counter) OTC trades, include deals of the foreign banks with other commercial banks which have systemic implications and therefore need strict vigilance to ensure conformation to regulatory stipulations.

***Systemic importance of the insurance sector***

20. The fast growth in the insurance sector in the decade since liberalization has further increased the importance of the sector mainly because of the growing inter-linkages of the sector with other financial institutions. The sector, by virtue of the intrinsic nature of the activities, faces risks related to: solvency, investment returns, economic down turns and issues related to 'persistence' though the sector is generally considered to be contributing less to systemic risk than banks.

**Regulatory environment**

***Strengthening the regulatory architecture - coordinated oversight for financial stability***

21. The Financial Stability and Development Council (FSDC), chaired by the Finance Minister, has been

established to strengthen the institutional framework for coordination among all regulators and the Government. The FSDC is assisted by a Sub-Committee under the Governor of the Reserve Bank, which is expected to evolve as the operative, hands-on body for financial stability in peace times with the FSDC having broad oversight and a central role in crisis times.

***Proposed amendments to banking legislations will fortify the regulatory structure***

22. Amendments to the banking sector legislations have been proposed with a view to fortifying and making more effective, the regulatory architecture while easing the access of the nationalised banks to capital market. Simultaneously, the Financial Sector Legislative Reforms Commission (FSLRC) has been set up with a mandate to revamp the financial sector laws. There is a case for reviewing the various legislations and recasting them in tune with current policy framework.

***Implementation issues remain with migration to the advanced approaches under Basel II***

23. Indian banks, at the aggregate level, remain adequately capitalised at present. The progress towards the advanced approaches under Basel II remains on a firm footing, amidst some challenges. The main implementation issues for the migration relate to constraints of data, tools, methodologies and necessary skills for quantification and modelling of risks.

***Data and analytical requirements for Basel III will be challenging....***

24. As the phase-in period for Basel III measures commences in 2013, the banks will need to gear themselves for the demanding data and analytical requirements for the revised liquidity framework. The position in respect of capital remains comfortable though some individual banks may need capital infusions which could pose some difficulties if the sluggish performance of the equity markets persists. The capital needs of banks will also be impacted due to the unamortised portion of pension liabilities to be absorbed by April 01, 2013 on migration to International Financial Reporting Standards (IFRS).

***...as will the calibration of the countercyclical buffers***

25. The calibration of the countercyclical buffers proposed under Basel III will require accurate assessment

as to whether the credit growth is excessive and/or is leading to the build-up of systemic risks. The commonly used indicators, including the ratio of credit to GDP, may not be suitable for India and a combination of qualitative judgment and quantitative indicators may be the way forward for assessing the requirement for, extent of and timing of imposition and removal of the buffer.

***The supervisory framework for Financial Conglomerates (FCs) is being enhanced...***

26. Efforts to improve the supervisory processes for the large and complex financial entities in the country are underway. The criteria for identification of FCs have been strengthened and a revised offsite reporting format has been introduced to improve capturing of the group risk profile. Guidelines on the corporate governance framework and management / monitoring of risks arising of intra-group transactions and exposures are also being finalised.

***... even as discussion on a Financial Holding Company model for India is set in motion...***

27. A Reserve Bank Working Group has recommended that the Financial Holding Company model should be pursued as the preferred model for the financial sector in India. However, necessary legislative and other changes will be required through discussions with the stakeholders for evolving an optimal structure for such companies under Reserve Bank's regulation.

***Gaps in the regulatory framework for NBFCs remain even as the entities in the sector remain closely interconnected***

28. Many NBFCs, which are borrowing both from the markets and the banks, have the capability of being over-leveraged and, being deeply interconnected, can pose systemic risks. Differences in regulatory requirements for such entities *vis-à-vis* the banking sector and between NBFCs under the purview of different regulators add to the scope for regulatory arbitrage. There remain gaps and weaknesses in the regulatory perimeter – wealth management activities, structured products, alternative investment funds like hedge funds, PE funds etc., - which need to be addressed. The systemic importance of Government owned NBFCs has grown over the years and the regulatory framework for such entities is being re-examined.

***Gaps in regulation permitting cooperative societies to raise funds outside any regulatory ambit need to be addressed***

29. Loopholes in the regulatory arrangements in the country permit co-operative societies to raise deposits from members and funds from external sources without being subject to any prudential framework. The entire gamut of issues related to raising of funds, especially from external sources, by these entities needs to be examined.

***An analytical prognosis of the network of the Indian banking system suggests significant degree of interconnectedness***

30. An analytical framework to assess the network of the Indian banking system reveals that the system is substantially connected and clustered. This intertwined nature of the banking system in any system could leave it vulnerable to domino effects in case of idiosyncratic failure of one or more banks. While the contagion impact is relatively contained due to regulatory limits on interbank exposures, there remains need for continuous monitoring of the interconnectivities in the financial system to identify build up of risks /excesses in the system and to guide policy action to address the same.

**Financial Market Infrastructure**

***Payment and Settlement Systems - Robust functioning...but vulnerabilities from interdependence needs to be monitored ...***

31. The operational performance of the payment and settlement infrastructure in India continued to be robust though vulnerabilities could emerge from the high degree of integration and inter-relationships among systems, processes and institutions involved in various segments of the payment and settlement systems. The benefits from synergies arising out of such interdependencies comes bundled with risks as stress on credit / liquidity aspects in one segment / institution / process may affect the other parts of the settlement system due to the cross-linkages.

***Vulnerabilities in the management of liquidity risks of Central Counterparties (CCPs) need to be addressed***

32. The management of liquidity risks faced by the CCPs entails addressing vulnerabilities arising from the quality and range of collateral, quantum of margins and

model risks. There are vulnerabilities in the Indian context arising from dependence on committed backup liquidity for funds and securities from financial institutions for completion of the settlement process (in the case of Clearing Corporation of India Limited, i.e. CCIL) and exposures to the banking sector as collateral is accepted the form of bank deposits, bank guarantees, etc. (in the case of other CCPs). The risks of the failure of a CCP, however unlikely, need to be addressed given the potential collateral damage from such an event. There are, however, no easy solutions given the moral hazard concerns which the provision of central bank liquidity for CCPs entails.

***Existing reporting arrangements for OTC derivative markets in India need to be leveraged***

33. The OTC markets in India with their skewed participation structures need greater attention towards standardization and introduction of central clearing even as some segments face low volumes making it difficult to mandate guaranteed clearing for these markets. The existing reporting arrangements for OTC markets encompass foreign exchange, interest rate, government securities, corporate bonds and money market instruments. Going forward, there is a need for consolidation and building on the existing reporting arrangements of CCIL while ensuring that the governance issues emanating from CCIL acting as both, a trade repository as well as a CCP, are addressed.

***Macro issues facing deposit insurance system in India remain relevant***

34. Ensuring the adequacy of the deposit insurance fund, reducing the time taken to reimburse depositors, improving the coverage of the deposit insurance system and broadening the mandate of Deposit Insurance and

Credit Guarantee Corporation (DICGC) remain critical issues for strengthening the deposit insurance system in the country. A Working Group is reviewing the issues.

**Stress testing**

***Capital adequacy shows resilience...though profitability gets affected***

35. Two new stress testing tools were added to the set of techniques used in the previous FSR. The first of these: Banking Stability Measures in the form of Banking System's Portfolio Multivariate Density (BSMD) approach for analysing financial stability from different combinations of distress dependencies, infers that during the periods of crisis, the systemic risks rise faster than individual risks. The second tool, based on Vector Autoregression (VAR) approach for judging the resilience of banking sector on various macroeconomic shocks by capturing the interaction among macroeconomic variables and banks' stability variables, shows that interest rate had the most significant (negative) impact on slippage ratio of the banks.

36. The resilience of the projected balance sheets of the commercial banks was studied through stress testing, in respect of credit risk, interest rate risk and liquidity risk. Under stress conditions based on NPA shocks, the profitability of the banks was seen to be affected significantly though the capital adequacy position appeared to be reasonably resilient. The study indicates that some banks may face extreme liquidity constraints, under severe stress scenario. Overall, the results of the macro-stress tests using different scenarios, suggested that the banking sector would be able to withstand macroeconomic shocks though the prevailing inflation and interest rate situation is expected to have an adverse effect on the asset quality of banks.

# Chapter I

## Macroeconomic Outlook

*Improvement in macroeconomic conditions at the global level has contributed to some moderation in risks to global financial stability. However, considerable uncertainty remains. Fiscal weakness and sovereign debt problems in the euro area, high leveraging in many advanced economies, banking sector default risks prevailing in some regions, the consequences of the Japanese earthquake, persistence of MENA turmoil and continuance of high energy and commodity prices may negatively impact investors' confidence and spending decisions of corporations and households.*

*On the domestic front, growth is likely to moderate while inflation is likely to remain firm due to rising commodity prices. This is expected to have an adverse impact on the fiscal consolidation process. The current account deficit is likely to remain elevated due to rise in imports resulting from higher oil and commodity prices, along with challenges of financing, as global conditions increase volatility in capital flows. High input prices and interest costs may result in downward pressure on margins of corporates. The aggregate impact of moderately paced global recovery, domestic growth moderation, upside risks to inflation and higher interest rates on the financial sector is likely to remain somewhat adverse during the year.*

### **Global risks decline but risks from inflation and capital flows remain high**

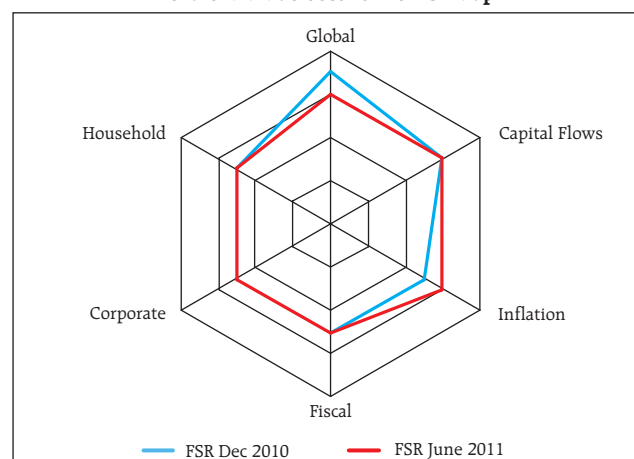
1.1. Since the publication of the second Financial Stability Report (FSR) of the Reserve Bank in December 2010, the signs of recovery in several advanced economies have strengthened. Some concerns regarding sovereign debt risks in the Euro Area, however, have re-emerged. On balance, the global risks have improved but remain elevated. On the domestic front, decline in risks due to moderation in capital flows has been offset by the increased volatility in portfolio flows. Risks from inflation have increased since December 2010. Corporate and household risks have remained at the same levels (Chart 1.1).

### **Global Developments**

#### ***Deceleration of global growth a concern...***

1.2. The Global Financial Stability Report (April 2011) has pointed out a decline in global risks since their previous assessment in October 2010 due to improvement in macroeconomic conditions. The growth in GDP during 2011, however, is expected to be lower in most countries, except Middle East and North African (MENA) and Sub-Saharan economies. The decline is most

**Chart 1.1: Macroeconomic Risk Map**



Source: Staff Estimates.

pronounced in the case of newly industrialised as well as developing economies in Asia (Chart 1.2).

1.3. Latest data on OECD Composite Leading Indicators (CLIs) point towards considerable variations in the pace of recovery in various economies during March 2011. While CLIs for North America, China and Russia point towards continued expansion, those for Brazil and India are pointing towards a slowdown relative to trend.

1.4. The manufacturing Purchasing Manager Indices (PMIs) for the U.S. and Europe, though in expansionary mode, have recorded a decline (Chart 1.3). The unemployment rate in the U.S. has also increased recently.

1.5. Downside risks to global growth include:

- High food, commodity and energy prices
- Withdrawal of fiscal stimulus measures and fiscal consolidation
- Reemergence of sovereign debt problems in the Euro area periphery and high level of fiscal debt in some advanced economies
- Continuance of structural global imbalances
- Slowdown in the U.S.
- Weakness in real estate and household incomes in some advanced economies
- Decline in GDP of Japan
- Prolonged political disturbance in MENA nations.

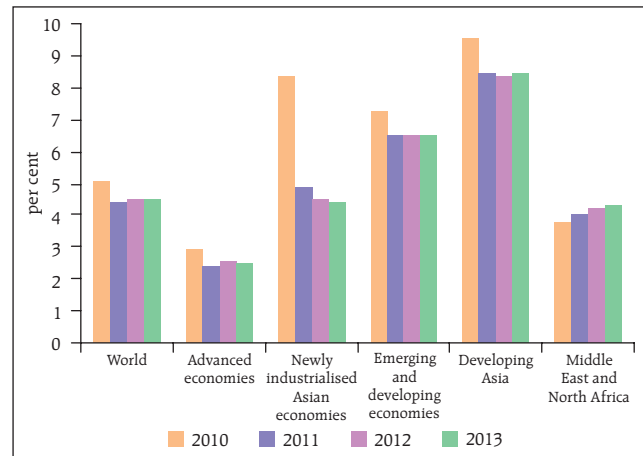
**...but decline in unemployment rate provides a silver lining**

1.6. Unemployment which peaked in 2009 and 2010 is trending downwards and is expected to improve the aggregate demand (Chart 1.4).

**Persistence of global imbalances is getting longer than what was expected...**

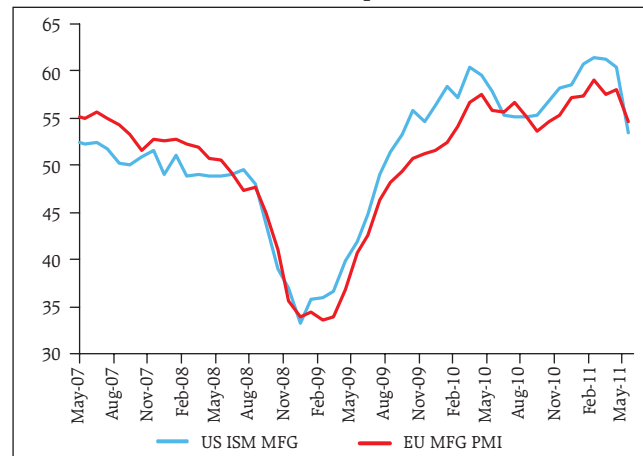
1.7. The structural causes of global imbalances have not been fully addressed and are reflected in the persistence of global imbalances. Though the trade balance of China has been fluctuating widely, it has largely remained in the surplus zone. The negative trade balance of the U.S., notwithstanding some moderation in the aftermath of the crisis, continues to be very large (Chart 1.5). As pointed out in the previous FSR, the process of rebalancing of external and internal imbalances is progressing albeit at a slower pace.

Chart 1.2: Deceleration of Growth in 2011



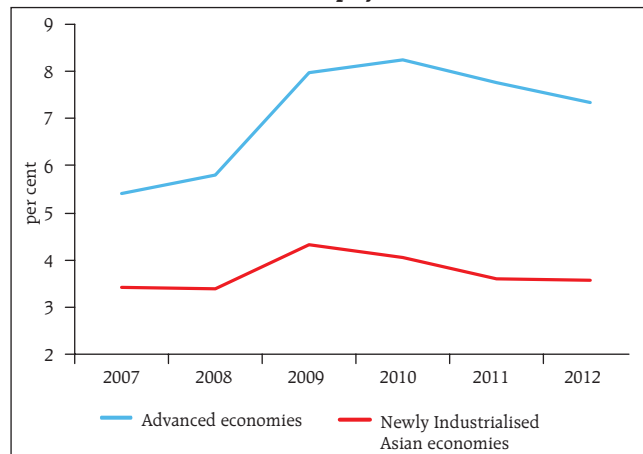
Source: IMF.

Chart 1.3: PMI in Europe and the U.S.



Source: Bloomberg.

Chart 1.4: Unemployment Rate



Source: IMF.

*... and same has been the experience with sovereign debt*

1.8. The sovereign debt crisis in Europe has returned full circle to the problem that started over a year ago. Notwithstanding the bail-out package, Greece has been slipping further behind its targets for cutting its budget deficit. The creditworthiness and the ability of accessing the market by the sovereign debt crisis economies remains impaired. The possibility of debt crisis spreading from the periphery to the core Euro zone countries and East European economies cannot be ruled out at this stage. The government debt is generally high and increasing in other advanced economies also (Chart 1.6).

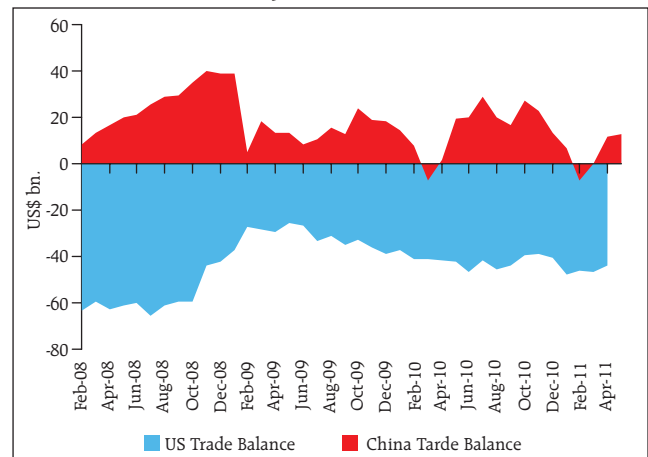
1.9. Some empirical studies<sup>1</sup> have pointed towards continuance of elevated fiscal stress risks above the pre-crisis years in advanced economies due to elevated solvency risks and high budget financing needs. Though fiscal stress is lower for emerging economies due to better fiscal space and higher growth prospects, fiscal risks remain high due to rising tension in growth and inflation dynamics.

*World trade recovering but may record moderate growth... Indian exports remain steady*

1.10. Global trade is recovering with the value of world merchandise trade, led by Asia, accelerating perceptibly in the fourth quarter of 2010 compared to the same period of 2009. In volume terms, world trade expanded by 12 per cent in 2010. World imports of Emerging Markets and Developing Economies (EMDEs) are back to pre-crisis trends, but those of advanced economies continue to lag. Japan's natural disaster may have some impact on East Asian economies, which have strong trade and financial links with Japan, before a reconstruction-led recovery starts.

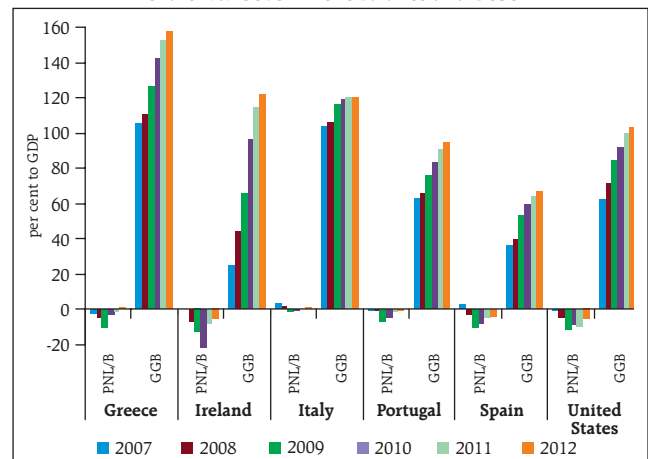
1.11. The robust growth in India's exports reflects diversification of products from labour intensive manufactures to higher value-added products in engineering and petroleum sectors and to destinations across emerging markets and developing economies. Geopolitical uncertainties in the MENA countries and the natural disaster in Japan are not expected to directly affect India's trade position given a moderate share of these regions in India's international trade; significant

Chart 1.5: Global Imbalances



Source: Bloomberg.

Chart 1.6: Government Balance and Debt



PNL/B: Primary Net Lending(+)/Borrowing(-).  
 GGB: Government Gross Debt.  
 Source: WEO, IMF.

<sup>1</sup> Baldacci, Emanuele, Iva Petrova, Nazim Belhocine, Gabriela Dobrescu, and Samah Mazraani (2011) Assessing Fiscal Stress, *IMF Working Paper* WP/11/100

indirect effects may, however, arise from the possible rise in oil prices and other commodity prices. As indicated in Chapter V, the impact of exports on the quality of banking assets has been found to be significant and hence the exposures to the export sector need to be monitored carefully.

**Domestic Economy**

***Real activity remains strong, though signs of moderation are visible***

1.12. The increase in the growth rate of real GDP during 2010-11 was mainly due to the sharp improvement in the growth of 'agriculture & allied activities', even as the contribution of industry and services were somewhat lower (Chart 1.7).

***Industrial growth decelerates, partly reflecting moderation in investment demand***

1.13. As highlighted in the previous FSR, the volatility in industrial production remains high. The volatility is largely due to fluctuations in capital goods production (Chart 1.8). Though the growth in capital goods sector has been rapid, the volatility reflects the uncertainties in the economy.

1.14. On the demand side, the acceleration in growth in 2010-11 largely reflects faster growth of exports vis-à-vis imports and acceleration in private final consumption expenditure and gross fixed capital formation. The growth rate of government final consumption expenditure moderated sharply in 2010-11 reflecting fiscal consolidation efforts; its share in GDP growth also declined sharply (Chart 1.9).

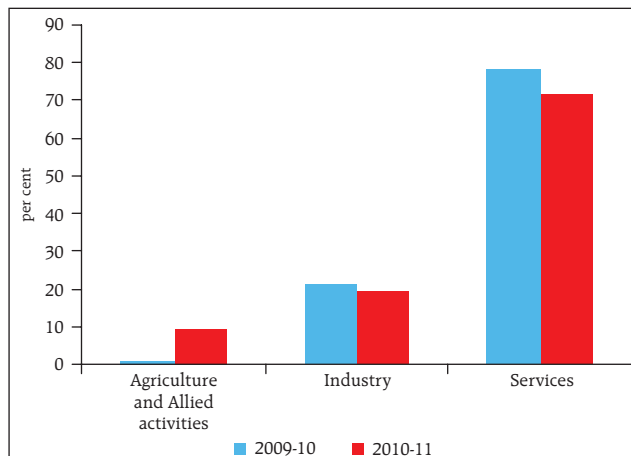
1.15. Downside risks to growth during 2011-12 include:

- Slackening of global recovery and external demand conditions
- Moderation in investment
- High oil and commodity prices
- Impact of monetary policy actions of the past and future.

***The impact of Basel III proposal for higher capital charge likely to be minimal***

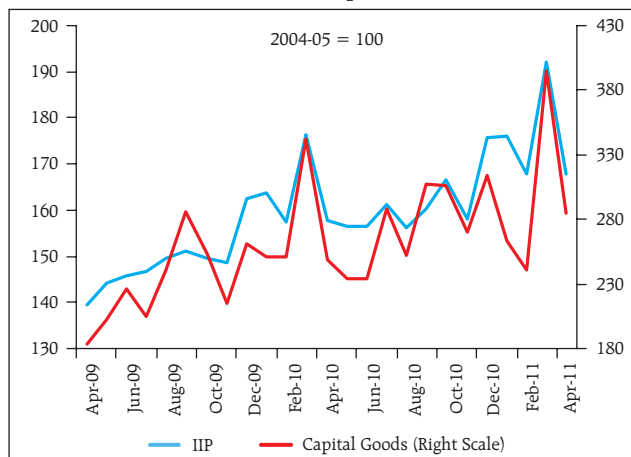
1.16. The Macroeconomic Assessment Group (MAG) of Basel Committee on Banking Supervision (BCBS) has estimated that annual GDP growth would fall by 0.03 percentage points for each percentage points increase

**Chart 1.7: Contribution to Growth – Supply Side**



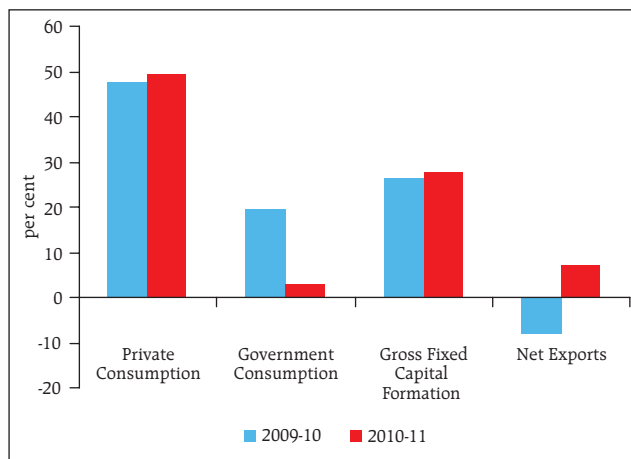
Source: CSO, Staff Calculations.

**Chart 1.8: Industrial and Capital Goods Production**



Source: CSO.

**Chart 1.9: Contribution to Growth – Demand Side**



Source: CSO, Staff Calculations.



in capital requirements. The Long-term Economic Impact (LEI) Working Group has estimated that one percentage point increase in the capital ratio would cause 0.09 per cent permanent decline in output. In a similar kind of study for Italy, the output decline over eight year horizon has been estimated to be 0.00 -0.33 per cent depending upon the estimation methods.<sup>2</sup> The Institute of International Finance (IIF), however, has assessed that the adoption of Basel III would cost about 3 per cent of GDP in Europe and U.S. The French Banking Association estimates double of this figure for the national economy. Some studies on global experience have shown that macroeconomic costs of increase in capital and liquidity requirements are sensitive to the length of the implementation period, adjustment strategy used by banks and the monetary policy response.

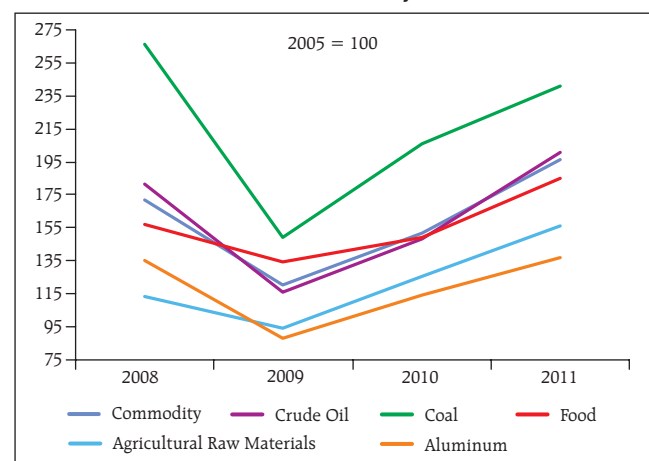
1.17. A preliminary assessment of the impact of increased capital requirements on GDP made by the Reserve Bank<sup>3</sup> showed that under ceteris paribus assumption, one percentage point increase in capital to risk weighted assets ratio (CRAR) could be associated with a marginal moderation in the average real GDP growth rate over a medium term horizon deriving from the impact of CRAR on bank credit growth and lending interest rate.

### ***Inflation stays elevated while the underlying drivers change***

1.18. Global food, energy and other commodity prices are likely to remain high during 2011 (Chart 1.10). Inflation at the global level is a concern as persistence of high global commodity prices would result in lower growth and higher inflation dispersed all over.

1.19. At home, inflation is likely to face upward pressure from fuller pass-through of oil and coal prices, higher subsidy expenditure of the government and rise in wages and raw material prices. Downward stickiness of inflation would also arise from structural component of food inflation along with higher global food prices.

**Chart 1.10 : Global Commodity Price Indices**



**Note:** Figures for 2011 are forecasts.

**Source:** IMF.

<sup>2</sup> Locarno, Alberto (2011): The Macroeconomic Impact of Basel III on the Italian Economy, Bank of Italy, May

<sup>3</sup> The assessment is based on a small analytical static macro model with inputs from annual balance sheets and profit and loss accounts data of the banking sector and macroeconomic aggregates. The study looked at one time impact, unlike the convergence pattern that some international studies including the BIS study simulated. The results are indicative and tentative, and subject to various assumptions including the key assumption that banks will continue to hold capital buffer in line with the baseline scenario. In the absence of these assumptions, the Basel III may not have any impact on real GDP growth.

**Gold prices continue to rise, while corrections are visible in housing prices in some centres...**

1.20. The quarterly House Price Index (HPI) for various centres, based on the official data on registration of property sale/purchase deed collected from the Department of Registration and Stamps (DRS) of various State Governments indicate continued firmness in housing prices in some centres and modest corrections in some others (Chart 1.11). Reports of unsold inventory in some centres may lead to further correction. Credit is growing at its trend rate and the servicing of these assets as reflected in housing NPAs ratio has continued to record improvement (Chart 1.19).

1.21. Since the crisis, the price of gold has recorded a secular rise (Chart 1.12). This may not pose much concern as its role as collateral, from anecdotal evidence, appears to be low.

**CAD to remain stretched due to combined impact of high global oil prices and moderation of growth in exports**

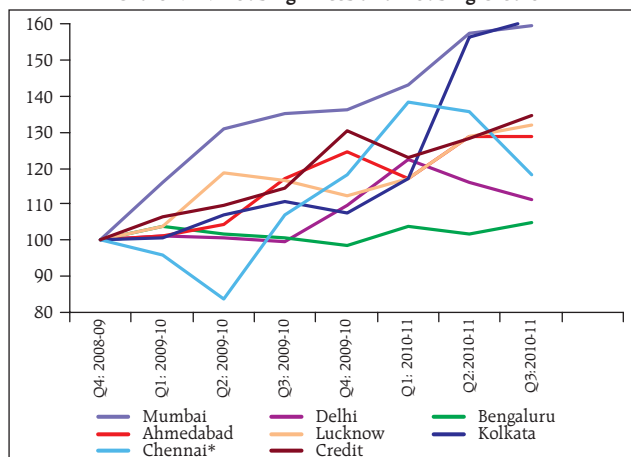
1.22. If oil and commodity prices remain elevated, the CAD will remain significant (Chart 1.13), although higher growth in software exports and remittances may provide some cushion. Financing of CAD is going to be a challenge as advanced countries begin exiting from their accommodative monetary policy stance. This could slow down capital inflows to EMEs, including India, as investors rebalance their portfolios.

**CAD continued to be financed by volatile portfolio flows while FDI remained subdued**

1.23. Capital flows have been found to be more volatile in emerging economies than in advanced economies. Further, in the post-crisis period, it has been observed that the share of debt creating flows have increased while that of FDI has declined, in general, among the emerging economies. IMF has observed that monetary tightening by U.S., especially if unanticipated, leads to decline in capital flows to economies having exposure to the U.S.

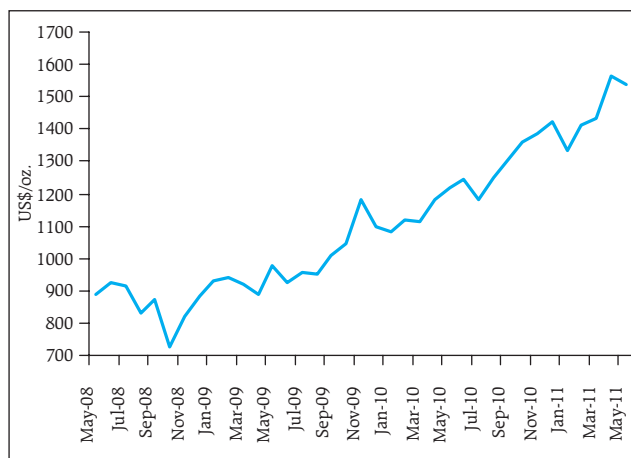
1.24. In case of India, the portfolio flows were stable during 2009-10 but turned volatile during 2010-11 reflecting the uncertainties at both global and domestic

Chart 1.11: Housing Prices and Housing Credit



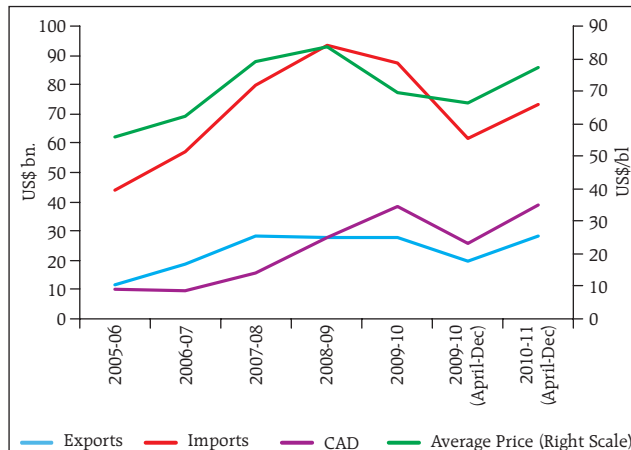
Source: RBI.

Chart 1.12: Gold Prices Continue to Rise



Source: Bloomberg.

Chart 1.13: Oil Trade and Price and CAD



Source: RBI.

levels (Chart 1.14). Thus, financing of CAD may face considerable risk as FDI, though stable, has not been exhibiting momentum. The composition and volatility of capital flows could have implications for external vulnerabilities, warranting close monitoring.

1.25. Some of the measures to ameliorate risks arising from capital flows are development of deep and liquid domestic financial markets, stronger macroeconomic and prudential policies and supervision, fiscal restraint and strong institutions.

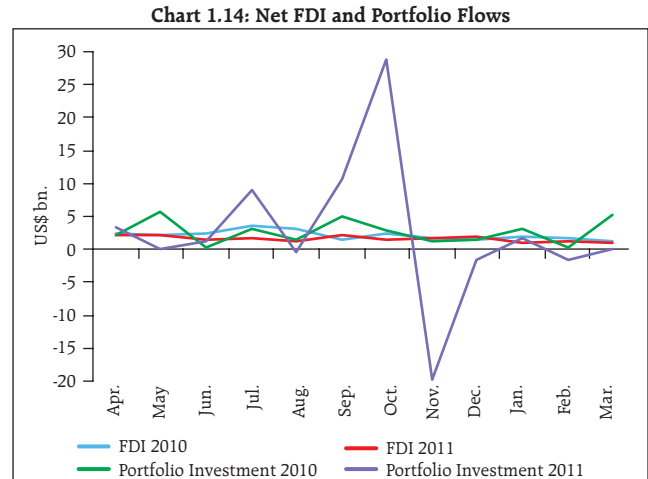
***Fiscal consolidation process to continue in 2011-12 but the quality and pace may matter***

1.26. The Union Budget 2011-12 has restarted the process of fiscal consolidation, which was temporarily put in abeyance in response to the crisis. There are, however, risks to the deficit projections of 2011-12 as subsidies are likely to exceed the budgetary provisions, given sharply higher international commodity prices (Chart 1.15). The Budget's lower projection of subsidies for 2011-12 is subject to the underlying assumption of no major variation in international fertilizer and petroleum prices during the entire span of 2011-12, which may not hold. The process of fiscal consolidation needs to be carried forward on both revenue and expenditures sides, with a sharper focus on the latter. Containment of subsidies by raising domestic prices of petroleum products and fertilizers should be a building block of this strategy.

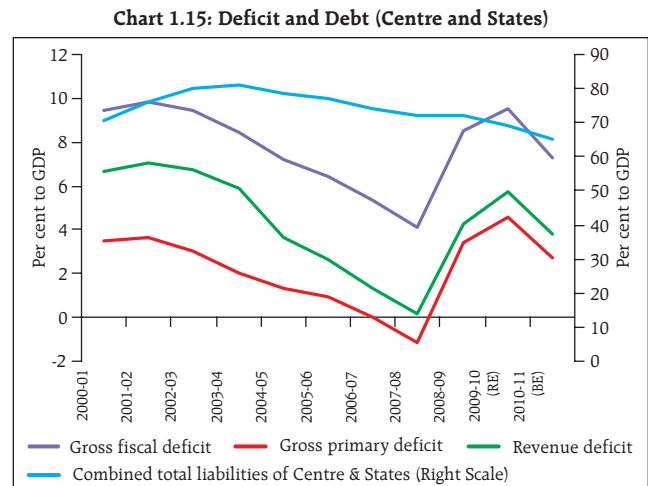
1.27. The rising international oil prices may generate pressures on the fiscal situation in case there is a delay in the corresponding adjustment in domestic prices, leading to larger subsidy expenditure towards under-recoveries of downstream oil public sector units. Furthermore, the introduction of the National Food Security Bill may also have additional expenditure implications. Moreover, the quality of fiscal consolidation remains a concern.

***Higher interest costs and commodity prices may put pressure on corporate margins***

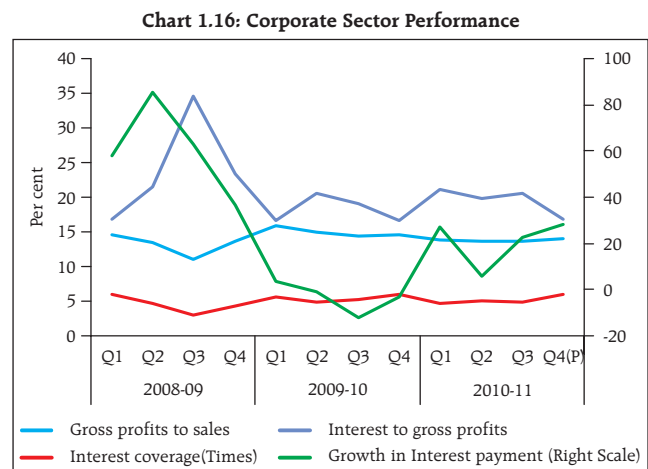
1.28. Reflecting monetary tightening, interest payment by the corporate sector has been rising and is likely to continue in the near future (Chart 1.16). This is likely to adversely impact the margins. Further, high and rising



Source: RBI.



Source: RBI.



Source: RBI.

commodity prices create cost pressures to firms and also reduce the real personal disposable income in the hands of households.

***Share of household sector credit records a decline but asset impairment in household sector remains high compared to the systemic average***

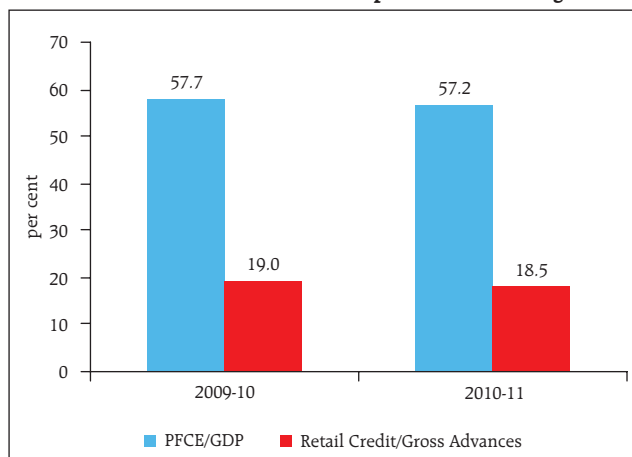
1.29. The share of private consumption is expected to decline marginally during 2010-11. In tandem, the share of retail credit in total advances also declined marginally thereby indicating that the risk from indebtedness of households to the banking sector has not increased during this period (Chart 1.17). Impairment of assets in the retail portfolio of banks remains higher than the systemic average but is witnessing some correction (Chart 1.18). Unlike the experience of some advanced economies, the asset impairment is relatively lower in housing sector and witnessing correction (Chart 1.19).

***Concluding Remarks***

1.30. Notwithstanding some improvement in the global macroeconomic environment and associated global risks, considerable uncertainties contribute to the continuance of global risks at elevated levels. Growth is expected to decline among most advanced as well as emerging and developing economies during the current year. Concomitantly, world trade is also likely to witness deceleration. Despite some moderation, global imbalances continue to persist implying that the process of rebalancing may take long and may require stronger policy measures. Reemergence and persistence of sovereign debt problems has posed additional challenges and is expected to prolong global recovery.

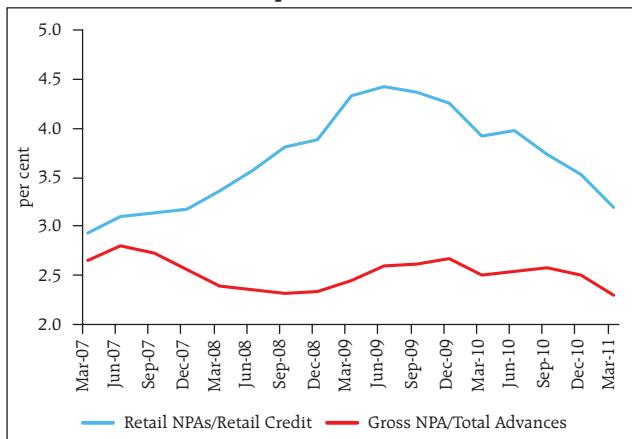
1.31. Slackening of global recovery, high oil and commodity prices, sovereign debt problem in the Euro area periphery intensifying and some slowdown in domestic investment demand may pose downside risks to the growth of the domestic economy. High prices of commodities, including oil, are also expected to adversely impact the current account balance, fiscal balance, households spending, and margins of corporates which may collectively pose some downside risks to the performance of the financial sector. Elevated inflation rate and rising interest rate may also impact on the balance sheet of financial entities.

**Chart 1.17: Household Consumption and Borrowing**



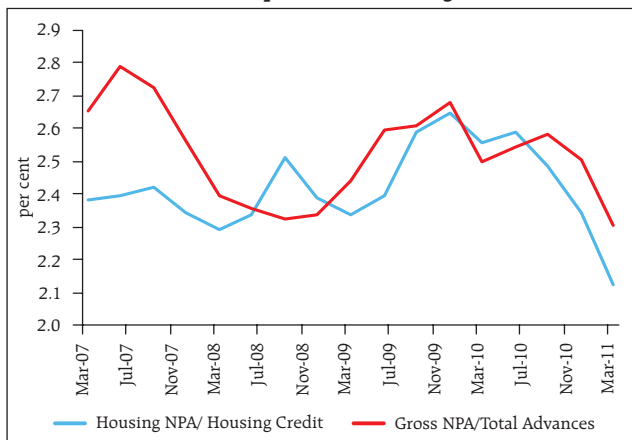
Source: CSO, RBI

**Chart 1.18: Impairment in Retail Assets**



Source: RBI.

**Chart 1.19: Impairment of Housing Assets**



Source: RBI.

## Chapter II

### Financial Markets

*Several advanced economies (AEs) are trying to break the mutually reinforcing cycle of low growth and high indebtedness. Very few have made progress that is promising, on this count. Heightened sovereign risk concerns may increase funding costs for not just sovereigns but financial institutions also which still face a substantial wall of financing needs. Competition among sovereigns and financial institutions for funding comes at a time when there is near-consensus among investors about stronger prospects in emerging market economies (EMEs). Given this backdrop, a small shock could have potential negative feedback effects that threaten markets beyond AEs. EMEs in turn are looking to shield themselves from capital flows in excess of their absorption capacity to prevent imbalances from developing in their own economies. In India, there are early signs of a greater reliance on foreign sources of funding. The flow and stock effects of greater internationalisation of the Indian markets, institutions and funding need to be prudently monitored and managed.*

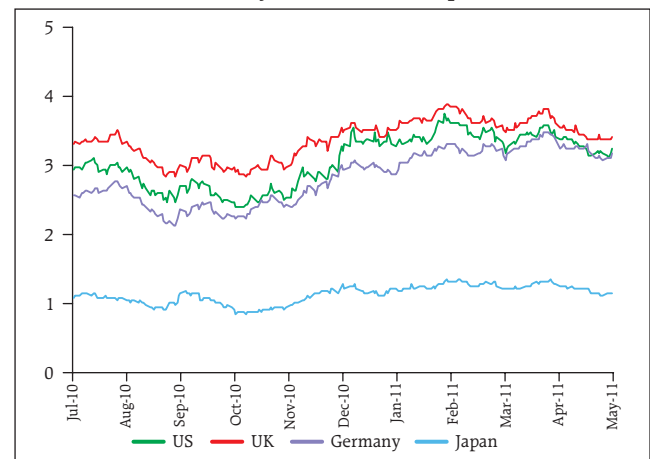
#### International Markets

2.1 Global financial markets remained orderly during the period since the release of the previous Financial Stability Report (FSR). Two events of systemic significance, the Japanese earthquake and conflict in Libya, caused sharp corrections in financial markets but their immediate impact appears to be waning slowly.

#### **Rate hike expectations for the year in US have fallen**

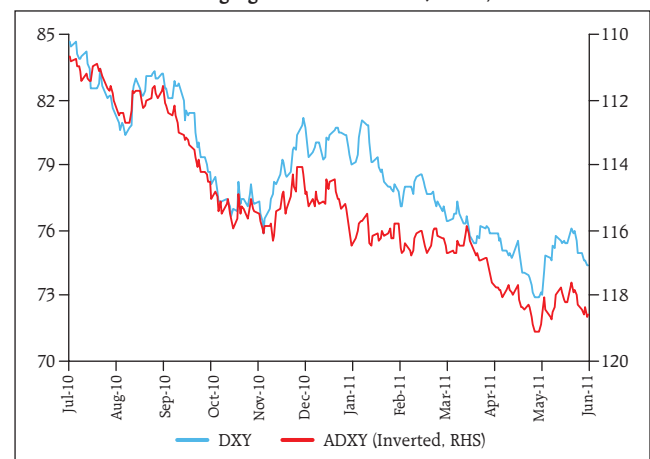
2.2 Monetary policy in AEs continues to remain accommodative. The Federal Reserve's policy rate, the Federal Funds Target Rate stands at 0 - 0.25 per cent, the second Quantitative Easing (QE II) programme of US\$ 600 billion is likely to conclude in June 2011 but the Federal Reserve would continue to reinvest the principal payments from its securities holdings. 10-year US treasury bond yields were trading below 3 per cent after the release of lower than expected rise in US payrolls data in early-June (Chart 2.1). Federal Reserve Chairman Bernanke has linked "sustained period of job creation" with a "truly established" recovery. The most notable development of this period has been the secular decline in the US dollar against most currencies (Chart 2.2), of both advanced and emerging markets. The US economic data has been soft enough to keep expectations of interest rate hike in check, but not weak enough to not sustain a strong growth. Expectations of rate hike by the Federal Reserve by December 2011 which

Chart 2.1: 10-year Bond Yields (in per cent)



Source: Bloomberg.

Chart 2.2: US dollar Against Advanced (DXY<sup>1</sup>) and Emerging Asian Currencies (ADXY<sup>2</sup>)



Source: Bloomberg.

were growing earlier in the year have since receded (Chart 2.3). This has allowed risk appetite to remain strong, and the US dollar to be used as a funding currency for risk asset trades. US equity indices traded with a positive bias during the period (Chart 2.4) with investors favouring stocks with greater exposure to emerging markets.

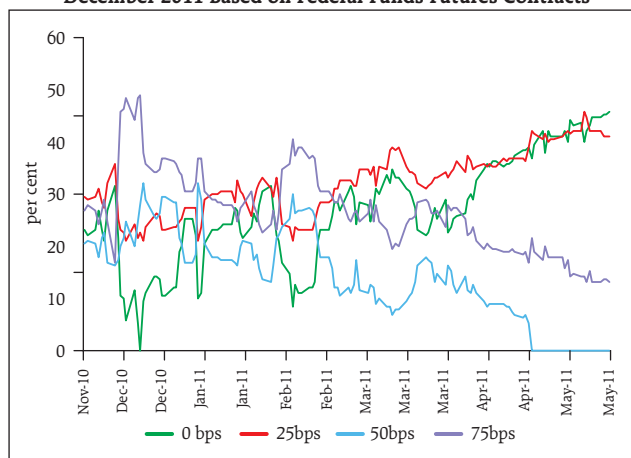
***Withdrawal of monetary accommodation in Euroarea has begun at an uncertain pace***

2.3 Meanwhile, in Europe, anticipation of policy normalisation in Euro-area has led to a steady rise in the Euro against major currencies, particularly, the US dollar, where policy would remain accommodative for a longer period. The European Central Bank (ECB) raised its policy rate, the refinancing rate, by 25 bps to 1.25 per cent in its meeting on April 7, 2011. The currency, however, fell after ECB kept its policy rate unchanged in its meeting in May 2011 and President Trichet did not meet expectations about further rate hikes in the market<sup>3</sup>. The Euro fell heavily against major currencies after the May 2011 meeting, and has remained soft with the emergence of greater uncertainties in regard to Greece. European equity has remained range bound.

***Prospects for UK and Japan have muddled***

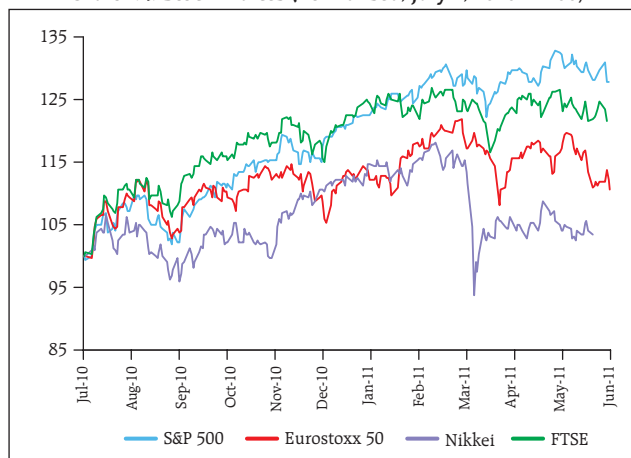
2.4 In the UK, inflation remained above the target of the Bank of England (BoE) while growth remained weak. BoE expects inflation to rise further this year and remain above its target of 2 per cent in 2012. UK equity and bond markets remained orderly but directionless. The Pound sterling gained from general US dollar weakness. In Japan, the earthquake in March 2011, which caused large scale destruction to capital stock, rattled financial markets. Japanese production and growth are expected to remain subdued until later this year when the repair work would give a boost to output in the economy. The equity market is yet to recover its initial losses while the bond market yields which initially rose on fears of another round of fiscal expansion fell back as its impact wore off. The Japanese yen rallied in the wake of the earthquake on fears that there would be large scale

**Chart 2.3: Federal Funds Implied Probability of Target Rate in Federal Open Markets Committee Meeting in December 2011 Based on Federal Funds Futures Contracts**



Source: Bloomberg.

**Chart 2.4: Stock Indices (normalised, July 1, 2010 = 100)**



Source: Bloomberg.

<sup>1</sup> DXY or the Dollar index indicates the international value of the US dollar against a basket of 6 major world currencies. The Euro has the highest weight in the index at 57.6 per cent followed by Japanese yen at 13.6 per cent, Pound sterling at 11.9 per cent, Canadian dollar at 9.1 per cent, Swedish krona at 4.2 per cent and Swiss franc at 3.6 per cent. An increase in its value suggests appreciation of the US dollar.

<sup>2</sup> ADXY is the Bloomberg - JP Morgan Asia Dollar index that is a trade and liquidity weighted index of ten Asian currencies against the US dollar. Chinese yuan has the highest weightage at 35.9 per cent and that of Indian rupee is at 7.8 per cent. An increase in its value suggests depreciation of the US dollar.

<sup>3</sup> President Trichet's press conference after the rate setting meeting is a key event for financial markets that pick on the use of the phrase "strong vigilance" in relation to price stability objective as a signal for further rate hikes. Reluctance of President Trichet to use the phrase led to disappointment in the market about the pace of rate hikes.

repatriation by Japanese financial firms of their investments abroad. These fears, however, proved unfounded. The currency remained very volatile for a period following the earthquake in March 2011 (Chart 2.5). The sharp rise in the currency was successfully reversed with joint intervention by Japan and other advanced country central banks.

### ***An earthquake transmits shocks to the financial system***

2.5 Initial assessments by the Japanese Cabinet Office put the damage to the economy's capital stock at around \$240 billion, which is more than double the damage following the Kobe earthquake in 1995. GDP growth for Japan in 2011 is expected to be lowered with Q1 growth at (-) 3.7 per cent despite the massive rebuilding effort sought to be launched by Japan in the second half of the year. In the first two business days after the earthquake, the Nikkei stock index fell almost 20 per cent, and Japanese sovereign 5 year CDS spreads jumped almost 50 basis points from around 100 basis points and 10-year government bond yields rose 10 basis points from around 1.2 per cent. The Japanese yen became very volatile in the aftermath of the disaster.

2.6 The Bank of Japan (BoJ) responded swiftly to the challenge. In the first week after the earthquake, it injected ¥37 trillion (US\$ 439 billion) into financial markets to ensure ample liquidity. It also increased the amount of its Asset Purchase Program by ¥5 trillion, with the aim of keeping premia on risk assets low. In response to the yen's sharp appreciation, the BoJ, together with other G7 countries, embarked on a coordinated intervention in the foreign exchange market.

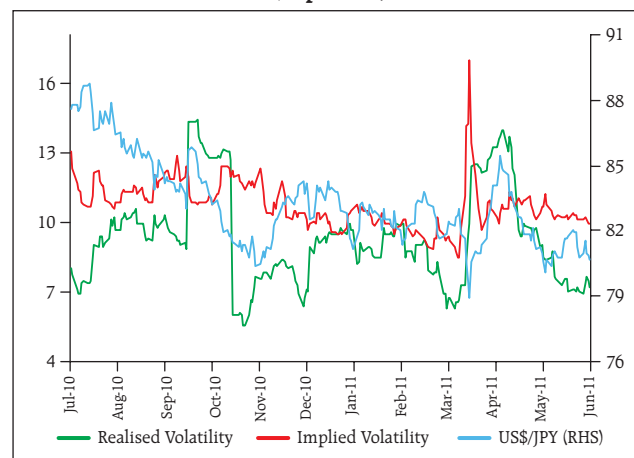
### ***Questions over sustainability of European sovereign debt remain***

2.7 The concerns with regard to sustainability of sovereign debt in the Euro-area do not appear as be localised to Greece, Ireland and Portugal (Chart 2.6) which have sought bailout packages from European Union and IMF. The adverse and mutually reinforcing facets of the problem, namely, low economic growth and high indebtedness in many advanced economies (AEs) has led to an unstable equilibrium.

### ***Fiscal concerns could spread to bigger economies***

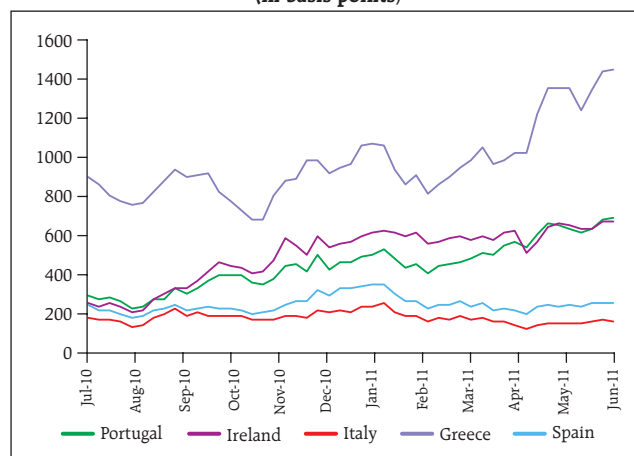
2.8 The European debt concerns pertain to relatively smaller economies of Greece, Ireland and Portugal. There are early signs of it spilling over into bigger European

**Chart 2.5: US\$/JPY Spot Rate and 1 Month Volatilities (in per cent)**



Source: Bloomberg.

**Chart 2.6: European Sovereign CDS in 5 - year Maturity (in basis points)**



Source: Bloomberg.

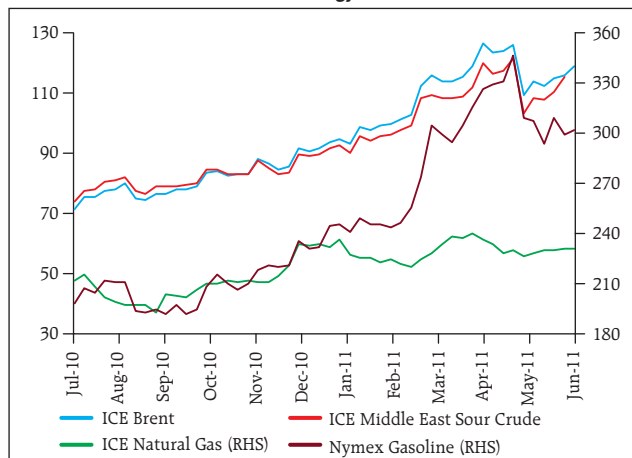
economies. S&P and Fitch placed Italy and Belgium on negative outlook in May 2011. Both countries have high debt, difficult fiscal prospects, and political challenges ahead. The moves added pressure to a battered euro area. Rising debt and deficit levels of bigger AEs, like US, UK and Japan are also inviting the attention of rating agencies. The concerns expressed by them have so far not rubbed off on risk or term premia on the long term debt of these sovereigns. The need to raise larger sums from the financial markets by AEs is coinciding with significant refunding requirements of international banks, mainly European ones. The wall of refinancing by such banks has to be carried in competition with not only domestic sovereigns but with emerging market assets which are perceived to have more favourable risk-reward attributes.

**Geopolitical tensions and stagflation risks**

2.9 Continuing tensions in the Arab world and the military conflict in Libya have had a direct impact on energy markets. Financial markets typically have low appetite for political risks. Equity, bond, credit and foreign exchange markets have corrected in view of the violence in Libya. A lengthy conflict in Libya, possibly combined with uncertainties about the viability of nuclear energy post-Fukushima, puts sustained upward pressure on global energy prices (Chart 2.7). This could add to existing concerns about inflationary pressures – not just in EMEs but in AEs where growth is still not on sound footing.

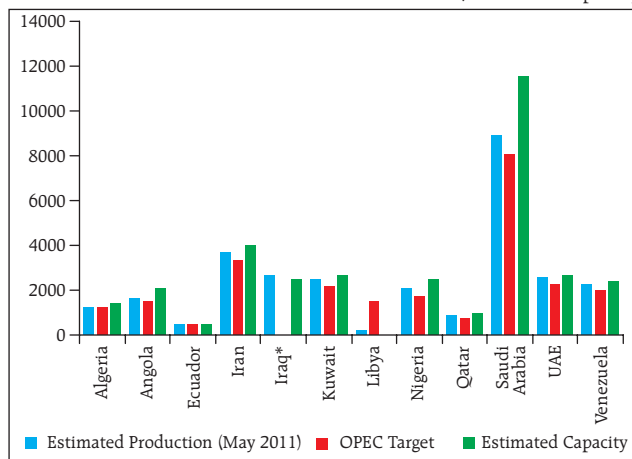
2.10 The oil industry’s supply dynamics have always been prone to disruption owing to low excess capacity and inventory levels (Chart 2.8). Precautionary stockpiling during such periods of political tension can aggravate the price moves in the energy markets causing distress to importing countries. At the same time, the higher revenues earned by the producers do not translate into any significant rise in export potential for others when the price moves are sharp. These developments have come at a time of high food and energy led inflation the world over. A resurfacing of stagflation risks of decades ago owing to oil supply shocks cannot be ruled out if the unrest were to spread to bigger oil exporters.

Chart 2.7: Near Month Energy Futures Prices (in US\$)



Source: Bloomberg.

Chart 2.8: OPEC Capacity Versus Actual Production and OPEC Quota (In 000s barrels per day)



\* Iraq has no formal OPEC Production Quota  
Source: Bloomberg



**Financialisation of commodity markets increases asset correlation**

2.11 Commodity prices (Chart 2.9) have traded with a positive bias since the global recovery and continued their advent during the period under review. The gyrations in commodity prices are often interpreted as early indicators of the changing prospects of the global economy, particularly that of EMEs. Increased financialisation of the energy and commodities market i.e. securitised commodity - linked instruments that are considered an investment rather than a risk management tool through Exchange Traded Funds, structured products and other vehicles has caused fears that genuine hedgers might get 'crowded out'. There is, however, little evidence of financial investors as being responsible for high commodity prices today. However their actions could be adding to price volatility and correlation of financial and commodity markets (Chart 2.10). This phenomenon facilitates faster emission of stress from commodities to financial markets.

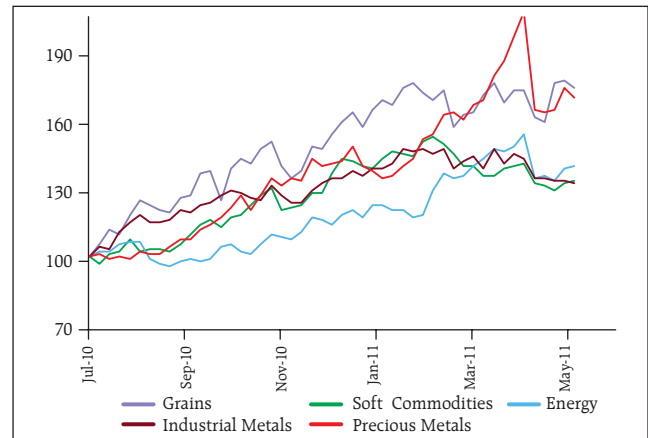
**Domestic Markets**

2.12 Domestic markets remained orderly without stress. This is evidenced by the Financial Stress Indicator (FSI)<sup>5</sup> (Chart 2.19).

**Autonomous factors cause banking system liquidity to remain in deficit**

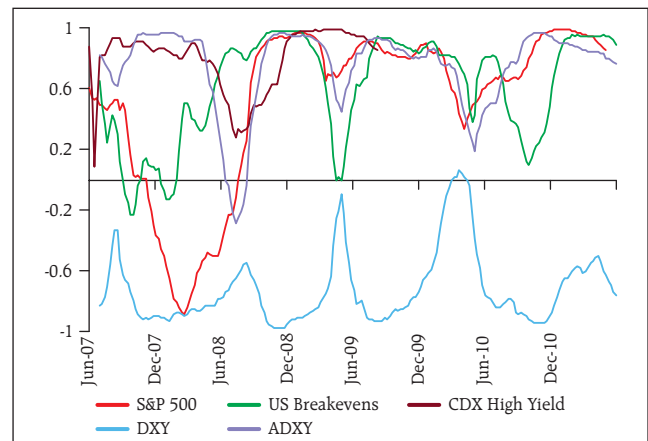
2.13 The banking system liquidity has remained in deficit mode for almost a year as reflected in the Liquidity Adjustment Facility (LAF) operations of the Reserve Bank (Chart 2.11). The factors affecting it have been the increase in required reserve resulting from the growth in bank credit and Net Demand and Time Liabilities (NDTL) and currency in circulation. In spite of a sharp turnaround in Government cash balances with the Reserve Bank during the current financial year, liquidity in the system remained in a deficit mode reflecting an increase in liquidity requirements of the economy. Volatility in the liquidity situation needs to be actively managed by the Reserve Bank.

**Chart 2.9: Commodity Price Movements<sup>4</sup> (normalised, 2 July 2010 = 100)**



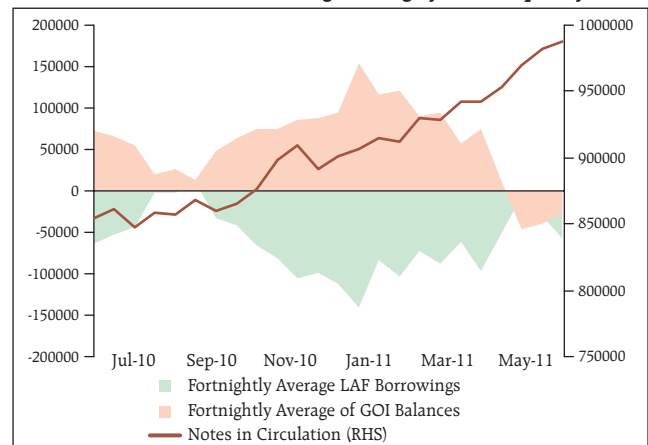
Source: Bloomberg.

**Chart 2.10: 30 - Day Rolling Correlation of Reuters - Jeffries CRB Index with various Assets**



Source: Bloomberg.

**Chart 2.11: Factors Affecting Banking System's Liquidity**



Source: RBI.

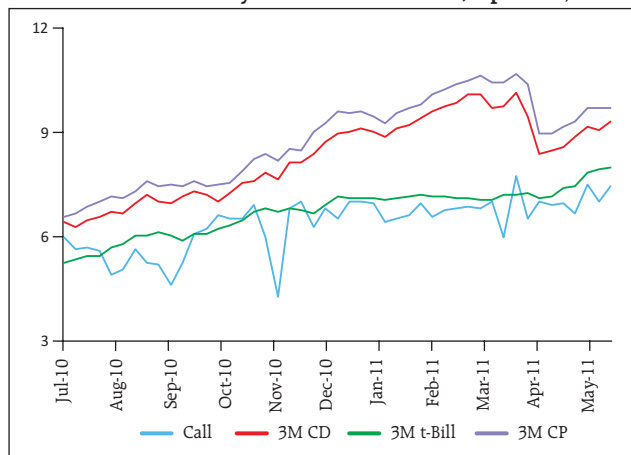
<sup>4</sup> Each component in various segments of commodities in the chart is as per the composition of the Reuters - Jeffries CRB Index.  
<sup>5</sup> The FSI is designed to capture the contemporaneous severity of the developments as they transpire in equity markets, bond markets, foreign exchange markets and the banking sector. Financial stress is defined as the force exerted on economic agents by uncertainty and changing expectations of loss in financial markets and institutions. Stress increases as uncertainty or expectation of increase in financial loss increase. The variables are selected for their timeliness, forward looking information and systemic relevance and availability of data.

2.14 The tightness in liquidity conditions on account of autonomous and frictional factors got reflected in money market rates (Chart 2.12). The call money rates generally hovered around the upper bound of the LAF corridor. Similarly, the interest rates in the CD market moved in tandem with the call rates, except during a brief period leading to March 31, 2011, when banks raised funds prior to the annual closing of accounts. Commercial Paper (CP) and Certificate of Deposit (CD) rates touched double digits and treasury bill rates too rose above 8 per cent on occasions. The rates in the collateralised segments generally continued to move in tandem with the call rate, and stayed below it. Transaction volumes in the collateralised borrowing and lending obligation (CBLO) and market repo segments showed marginal improvement in Q4 compared to Q3 of 2010-11. Banks and primary dealers continued to remain the major group of borrowers in the collateralised segments whereas mutual funds (MFs) remained the major group of lenders of funds in these segments. The collateralised segment of the money market continued to remain the predominant money market segment, accounting for more than 80 per cent of the total volume during this period.

2.15 The government bond yields rose across the yield curve during the period under review with shorter maturities rising slightly faster (Chart 2.13). As a result, the yield curve flattened. Initially, there was a downward bias to yields on account of announcement by SEBI on auction of unutilised investment limits for FIIs for government securities and corporate bonds and a lower than expected April-September borrowing amount announced by the Central Government. Yields have, however, hardened with inflation rising beyond expectations on each occasion since September 2010 (May, April, March and February 2011 Wholesale Price Index (WPI) stood at 9.1, 8.7, 8.9 and 8.3 per cent respectively) raising expectations of further monetary tightening (Charts 2.14 & 2.15). In early-June, 2 - year bond yields exceeded those of 10 - year bonds causing a minor inversion in the yield curve.

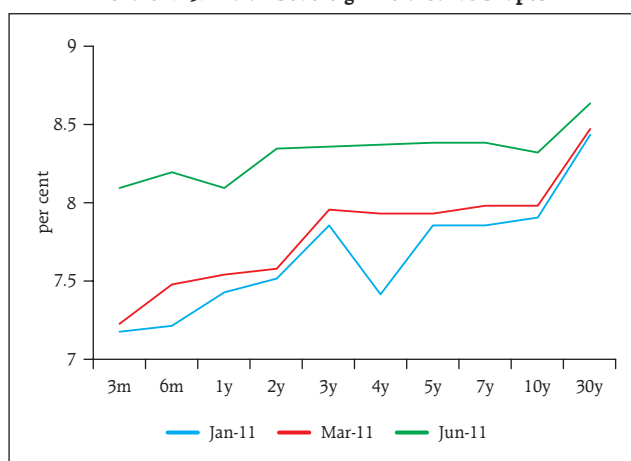
2.16 The Indian rupee remained in a range against the US dollar during the period under review despite several

Chart 2.12: Money Market Rates in India (in per cent)



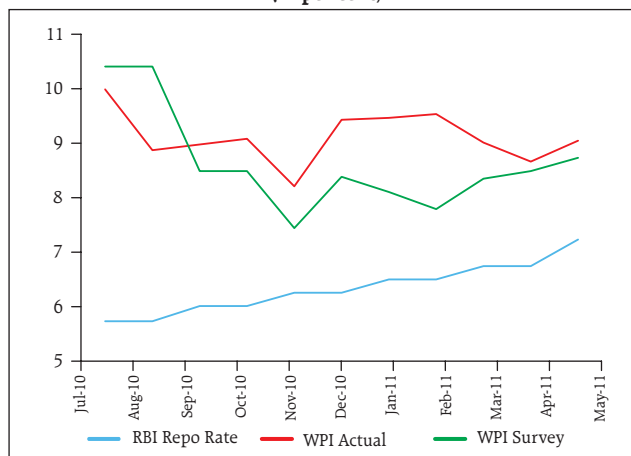
Source: Bloomberg.

Chart 2.13: Indian Sovereign Yield Curve Shapes



Source: Bloomberg.

Chart 2.14: WPI Inflation Forecasts<sup>6</sup> and Actuals, and RBI Repo Rate (in per cent)



Source: Bloomberg.

<sup>6</sup> Bloomberg survey of professional forecasters, bank economists and investment analysts before the release of the WPI inflation figures is used.

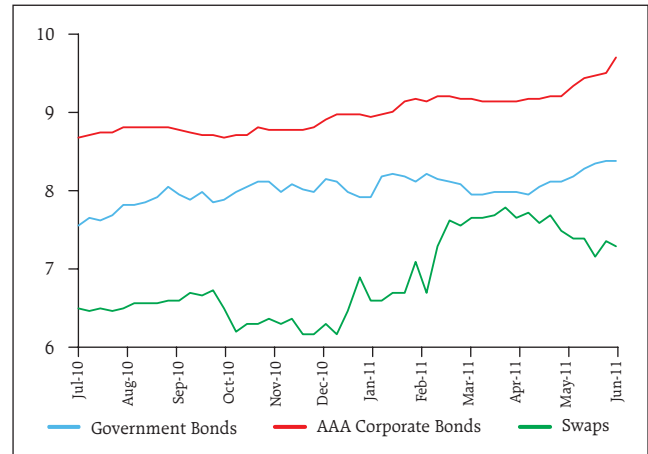
adverse factors, namely, high crude oil prices and slump in FDI. It was initially aided by a recovery in portfolio flows, including equity and debt capital (debt capital flows have remained strong since last year) (Chart 2.16) and narrowing of current account deficit. Banking capital which witnessed net outflows in Q3 2010-11 turned positive in Q4 2010-11. The general US dollar weakness globally has helped the Rupee further its gains. The correction in equity markets as a result of high inflation numbers and the attendant rate hikes during the period weakened the Rupee which gave up most of its gains.

**Financialisation versus internationalisation of Rupee**

2.17 The offshore trading activity in the Indian rupee has been increasing at a rate much higher than that estimated by market participants (2010 Triennial Central Bank Survey of BIS). Some recent work on the share of offshore markets by Robert McCauley and Michela Scatigna (BIS Quarterly review – March 2011 and earlier by Ho et al (2005) and McCauley (2010)) has attempted to provide simple benchmarks for 'turnover' and 'location' of currency trading, and highlight some important cases of deviations from those benchmarks. Their report shows that as the GDP rises, a currency trades in greater multiples of the home economy's underlying international trade ("financialisation") and trades to a greater extent outside its home market ("internationalisation").

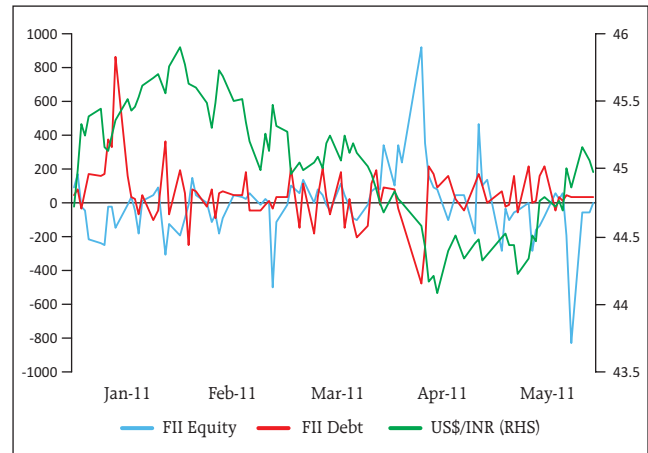
2.18 On the basis of the relationship between turnover and income, Indian rupee stands out, as it trades more in proportion to India's trade (exports and imports) and income. This may partly be explained by the relatively large outright foreign investments in India's equity market and also by the rapid growth in onshore rupee futures market. Also, the turnover in Indian rupee, which is high-yielding, benefits from 'carry trade' strategies in forward markets (both deliverable and non-deliverable) and futures (Galati et al (2007)). The relatively higher financialisation of the Indian rupee compared to the Chinese renminbi reflects the more liberal foreign exchange regime put in place in India. India has already achieved current account convertibility and has a more open capital account.

Chart 2.15: Bond Market Yields in 10-year Maturity (in per cent)



Source: Bloomberg.

Chart 2.16: FII Equity and Debt Daily Net Flows (US\$ million) and Exchange Rate of Rupee



Source: Bloomberg.

### ***Increasing reliance by corporates on foreign currency borrowing***

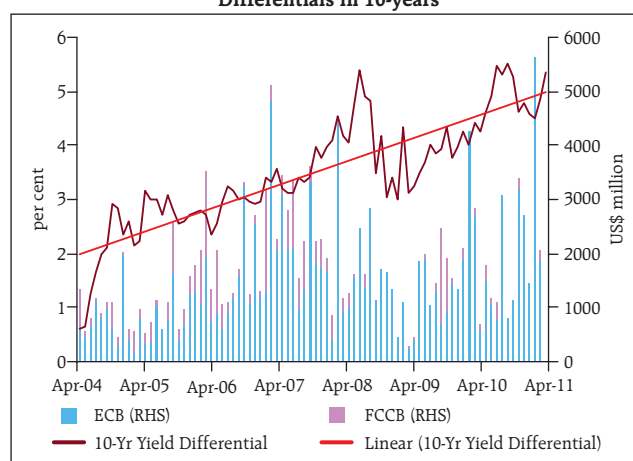
2.19 The two track growth and divergent course of monetary policy followed in EMEs vis-à-vis AEs has led to an ever-widening interest rate differential. This has natural implications for interest rate-sensitive capital flows into the EMEs (Chart 2.17). Over the past few months, there has been a discernible increase in External Commercial Borrowings (ECBs) registered with the Reserve Bank, both under the Automatic as well as the Approval Routes (Table 2.1) and the aggregate ECB flows for 2010-11 were almost at the pre-crisis levels. Increased reliance by corporate on foreign currency funding also increases the currency mismatches in their balance sheets.

### ***Substitution of domestic bank credit***

2.20 Bank credit has historically been the dominant funding source for corporate in India. However, with the easy access to foreign currency credit and availability of alternate domestic funding channels, particularly the corporate debt market, some amount of disintermediation in the financial system is already evident. An internal study was conducted to empirically show the relationship between ECB and corporate bond outstandings and the outstanding bank credit. Granger Causality test under VAR(1)<sup>7</sup> framework has been used for this study. The first difference of log of all the three variables was taken for the modeling exercise. The result for Granger Causality of changes in outstandings of corporate bond and ECB to bank credit outstandings is presented in Table 2.2, whereas, estimated parameters for bank credit equation is shown in Table 2.3.

2.21 It may be observed that the null hypothesis that corporate bonds and ECB jointly do not granger-cause bank credit to change cannot be accepted. In other words, the two variables, ECB and corporate bonds jointly influence bank credit. Further, both, coefficients of ECB and corporate bonds are negative, which implies that a rise in the two variables causes a fall in Rupee denominated domestic bank credit. As access to foreign currency borrowing is regulated in price as well as quantum terms, given the capital account management

**Chart 2.17: Trend in ECBs and FCCBs and Interest Rate Differentials in 10-years**



Source: RBI and Bloomberg.

**Table 2.1: ECBs Registered with the Reserve Bank (in US\$ million)**

|       | 2007-08 | 2008-09 | 2009-10 | 2010-11 |
|-------|---------|---------|---------|---------|
| ECB   | 22,224  | 15,462  | 17,363  | 24,481  |
| FCCBs | 6,103   | 463     | 3,362   | 1,270   |
| Total | 28,327  | 15,925  | 20,725  | 25,751  |

**Table 2.2: VAR Granger Causality**

| Excluded Variable | DLCorporate_Bonds | DLECB | All  |
|-------------------|-------------------|-------|------|
| Chi-sq            | 5.94              | 2.36  | 7.50 |
| p-value           | 0.01              | 0.12  | 0.02 |

Source: RBI Staff Calculations

**Table 2.3: Parameter Estimates**

| Equation      | Variables              | Parameter estimate | p-Value |
|---------------|------------------------|--------------------|---------|
| DLBank_Credit | Constant               | 0.10               | 0.00    |
|               | DLBank_Credit (-1)     | -0.28              | 0.11    |
|               | DLECB(-1)              | -0.13              | 0.14    |
|               | DLCorporate_Bonds (-1) | -0.45              | 0.02    |

Source: RBI Staff Calculations

<sup>7</sup> Vector Autoregression (1)

framework, true disintermediation away from the banking system would be critically contingent on the development of a deep corporate bond market.

### ***Growing currency mismatches of the national balance sheet***

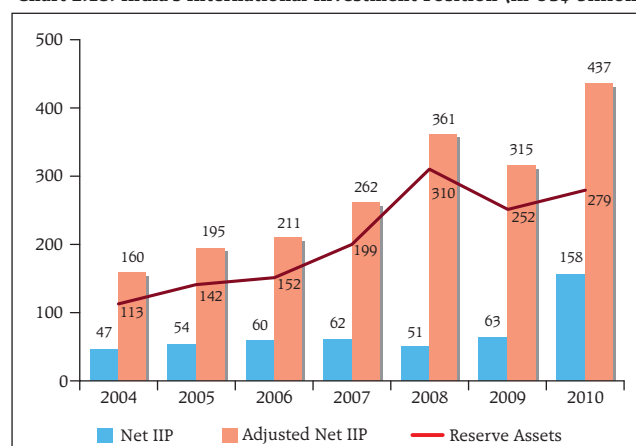
2.22 The trend of greater reliance on external borrowings by firms in India over the years is showing up on the country's International Investment Position (IIP). The non-official sector's exposure to currency risk has increased in the last few years, with an increasing net liability position *vis-à-vis* non-residents (Chart 2.18). Foreign claims on Indian assets denominated in Indian rupee is far greater than that of residents in foreign currency denominated overseas assets. India's net external liabilities have increased from US\$ 47 billion as on March 31, 2004 to US\$ 158 billion as on March 31, 2010. It may be mentioned that these external liabilities include the foreign currency loans given by overseas branches of Indian banks to domestic corporates. There has been a consistent increase in such borrowings over the past few years (Table 2.4).

2.23 The net liability of the non-official sector (referred to as the Adjusted net IIP in the chart), has risen even more from US\$ 160 billion to US\$ 437 billion. This means that the aggregate translation risk for the non-official sector arises from a depreciation of the local currency, i.e. the Indian rupee. China has a net asset position on its IIP. Its net IIP improved from US\$ 1.2 trillion in 2007 to US\$ 1.8 trillion in 2009 and its exposure is to an appreciation of its local currency, the Renminbi. The contrasting risk exposures of the national balance sheets can be observed in the prices for 25 delta risk reversals<sup>8</sup> on the exchange rates. For Indian rupee, the figure is always positive whereas for the Chinese renminbi, which is aided by a surplus on the current account, it rose above zero only during extreme risk aversion of 2008-09 (Chart 2.19).

### ***Rising refunding risks of corporates***

2.24 During the three financial years in 2005-06 to 2007-08, Indian firms raised foreign capital through

**Chart 2.18: India's International Investment Position (in US\$ billion)**



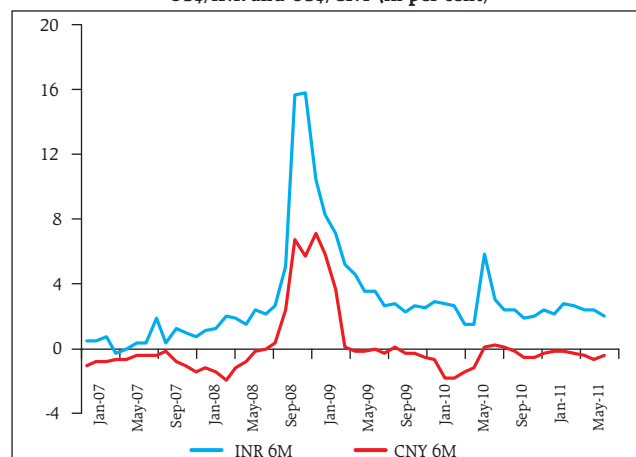
Source: RBI

**Table 2.4: Lenders' Profile of ECBs (in US\$ million)**

|                                        | 2007-08          | 2008-09         | 2009-10         | 2010-11          |
|----------------------------------------|------------------|-----------------|-----------------|------------------|
| Total ECB                              | 28,327           | 15,925          | 20,725          | 25,751           |
| <i>Of which lent by :</i>              |                  |                 |                 |                  |
| Overseas branches of Indian banks      | 2,880<br>(10.2)  | 1,495<br>(9.4)  | 2,303<br>(11.1) | 5,127<br>(19.9)  |
| Foreign Bank                           | 17,272<br>(61.0) | 8,864<br>(55.7) | 8,438<br>(40.7) | 13,692<br>(53.2) |
| International Financial Institutions   | 1,180<br>(4.2)   | 2,643<br>(16.6) | 3,133<br>(15.1) | 2,849<br>(11.1)  |
| International Investors                | 6,373<br>(22.5)  | 463<br>(2.9)    | 3,334<br>(16.1) | 1,455<br>(5.7)   |
| Foreign Collaborator/<br>Equity Holder | 621<br>(2.2)     | 2,458<br>(15.4) | 3,514<br>(17.0) | 2,597<br>(10.1)  |

Note: figures in brackets represent the percentage for each category of lenders.  
Source: RBI.

**Chart 2.19: 25 Delta Risk Reversals in the 6 Month Maturity for US\$/INR and US\$/CNY (in per cent)**



Source: Bloomberg

<sup>8</sup> The risk reversal is a skew in the demand for out-of-the-money options at high strikes compared to low strikes and can be interpreted as the option market's view of the most likely direction of the spot movement over the next maturity date. It is defined as the implied volatility for call options minus the implied volatility of put options on the base currency. In the case of both Indian rupee and Chinese yuan, the base currency is US dollar. A positive number means that market participants are willing to pay a slightly higher price to buy call options on US dollars when compared to put options on US dollars and vice versa.

Foreign Currency Convertible Bonds (FCCBs) which were very popular at the time. The conversion price on such bonds was 25 - 150 per cent higher than the prevailing stock price at the time of issuance and they carried zero or very low coupons. This is reflected by the consistent growth in FCCB issuance during 2005-08. FCCB proceeds were meant for overseas acquisition (19 per cent) and import of capital goods (16 per cent) as per returns filed by firms.

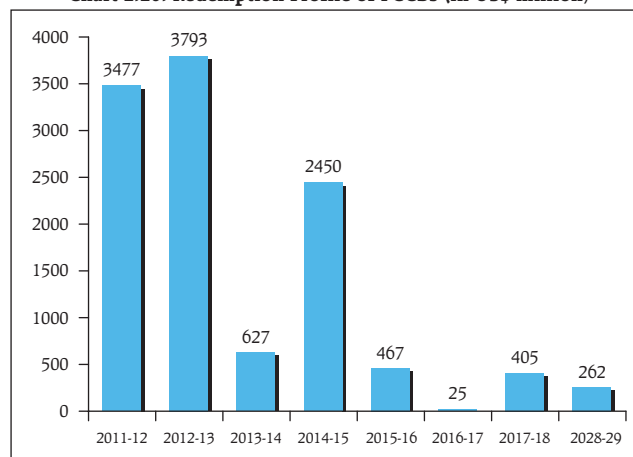
2.25 FCCBs, which are normally issued for a maturity period of more than five years, worth more than US\$ 7 billion are maturing by March 2013 (Chart 2.20). Of these, CRISIL estimates that "FCCBs worth ₹ 220 - 240 billion may not get converted into equity shares, as the current stock prices of issuing companies are significantly below their conversion prices... The Nifty is now only about 10 per cent below its highs in January 2008. But many of these companies, accounting for more than half of the outstanding FCCBs, are trading at a discount of more than 50 per cent to their January 2008 prices". More than a few firms potentially face severe funding problems in the next two years which may not remain confined to their industries.

### *Herd behaviour of portfolio capital*

2.26 During 2010, Indian capital markets received a very significant amount of net portfolio capital flows (US\$ 29 billion in equities and US\$ 10 billion in debt) apart from a large sum under the heads of ECB and trade credit. In particular, between August and October 2010, as much as US\$ 18 billion was received under portfolio equity capital. IMF has stated<sup>9</sup> that "*Econometric results suggest portfolio flows to emerging markets tend to be persistent and have high degrees of autocorrelation... High persistence in flows is often attributed to herding behaviour*".

2.27 To test for persistence of flows, autocorrelation exercise for capital flows into India was done for various time periods beginning 2007 (Table 2.5). It shows that portfolio equity flows are autocorrelated (in a statistically significant manner) while that of debt flows are not in the first and second order (Lags of 1 and 2 in daily observations). Net overall portfolio flows too are

Chart 2.20: Redemption Profile of FCCBs (in US\$ million)



Note: Redemption profile is as of March 2011

Source: RBI

Table 2.5: Autocorrelation Coefficients at the First and Second Lag Level for Daily Net FII Flows in Equity and Debt into India

| Period                  | Lag | FII Debt    | FII Equity        | Total FII  |
|-------------------------|-----|-------------|-------------------|------------|
| Jan 2007 until May 2011 | 1   | -0.03(0.39) | <b>0.41(0.00)</b> | 0.29(0.00) |
|                         | 2   | 0.04(0.33)  | <b>0.29(0.00)</b> | 0.24(0.00) |
| Jan 2010 until May 2011 | 1   | 0.23(0.00)  | <b>0.43(0.00)</b> | 0.36(0.00) |
|                         | 2   | 0.05(0.00)  | <b>0.33(0.00)</b> | 0.25(0.00) |

Note: The number given in the bracket is the p-value for the test statistic. It is the lowest level of significance at which the null hypothesis that the test statistic does not have any autocorrelation (upto the specified lag level).

Source: RBI Staff Calculations, Bloomberg

<sup>9</sup> Global Financial Stability Report, October 2010

autocorrelated (statistically significantly) for all periods, presumably being dominated by equity flows. Debt FII flows into government and corporate bond markets in India face overall caps.

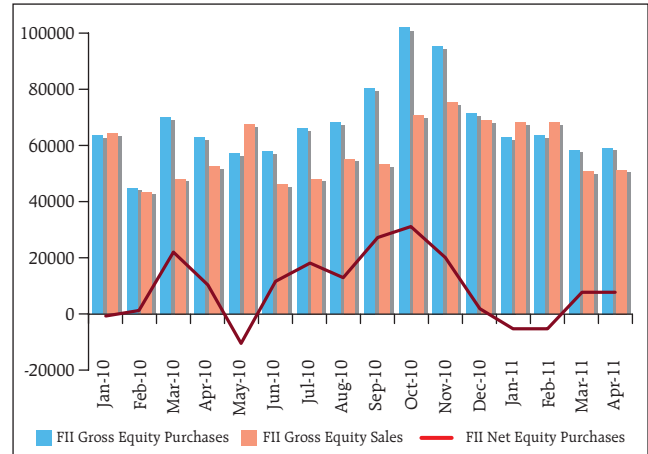
2.28 The study shows that capital flows tend to be influenced by past behaviour. The inflow of funds into EM countries, like India, is often self reinforcing with success in initial investments by a fund leading to further allocation by the same fund as well as emulation by others. Likewise, withdrawal at times of stress by a few becomes more widespread owing to herd behaviour even when fundamentals do not warrant action by all. The strains arising out of Middle East and North Africa (MENA) discussed above have unsettled global markets and a return to higher volatility and risk aversion cannot be ruled out.

**Debt inflows have offset equity outflows**

2.29 While equity market in India has corrected lower with FII investors pulling money out of it, the bond markets have been relatively stable. FII net outflows from equity market in January and February 2011, has been more than offset by the bond market net inflows (Charts 2.21 and 2.22). The inflows into bond market can be attributed to the recent expansion of limits for FII investment in corporate bonds and the fact that tight liquidity conditions in the interbank markets have propelled bond yields to attractive multi-year highs.

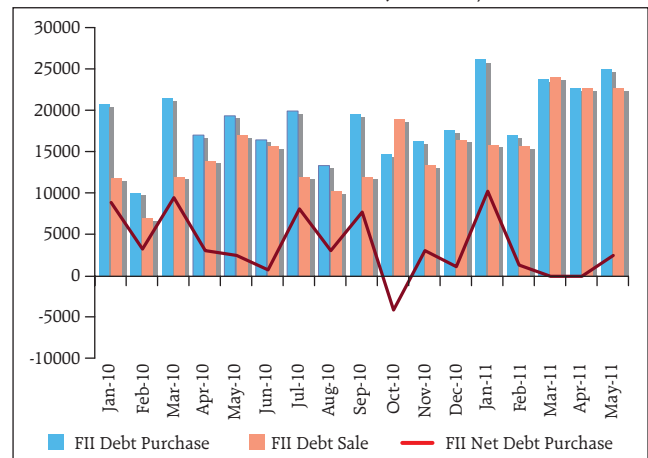
2.30 The pursuit of easy monetary policy by the US Fed and the other central banks and the resultant global liquidity has had little impact on the domestic macroeconomic situation so far. The Reserve Bank is committed to use a prudential mix of policy instruments to contain any adverse impact of such policies. At the same time, it is recognised that the global recovery will not be firmly established unless and until the US economy is surely and irreversibly restored to its potential growth and low unemployment levels prevalent pre-crisis. Any US domestic policy framework which makes this possible is in interest of the EMEs and the adverse fallouts of policies undertaken to achieve that have to be addressed with appropriate policy instruments available at the latter's disposal.

**Chart 2.21: FII Gross Monthly Purchases and Sales in Equity Markets (in ₹ crore)**



Source: Bloomberg.

**Chart 2.22: FII Gross Monthly Purchases and Sales in Debt Markets (in ₹ crore)**



Source: Bloomberg.

**Smart Order Routing (SOR) in Indian equity facilitates algo trading**

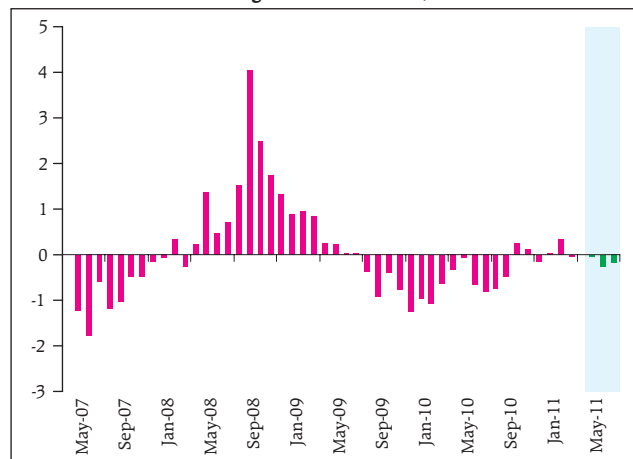
2.31 Based on the proposal received from stock exchanges and market participants, Securities and Exchange Board of India (SEBI) has introduced the facility of SOR which allows the brokers' trading engines to systematically choose the execution destination based on factors *viz.* price, costs, speed, likelihood of execution and settlement, size, nature or any other consideration relevant to the execution of the order<sup>10</sup>. This facility would help brokers execute client orders efficiently by providing the best price available across multiple trading venues (Stock Exchanges) through the use of High Frequency Trading (HFT) or Algotrading (Box 2.1). Indian securities market has shown remarkable resilience to systemic events previously. It would need to guard against 'flash crashes' of the kind that rattled US equity markets on May 6, 2010.

**Forecast of FSI suggests benign conditions until August 2011**

2.32 The Financial Stress Indicator is a measure that is designed to capture the contemporaneous severity of the

developments as they transpire in equity markets, bond markets, foreign exchange markets and the banking sector. In order to forecast FSI, univariate time series models (ARIMA, ARCH, and GARCH) has been used to forecast each of the component indicators of the FSI. The projected FSI for the period until August 2011 is well below the constructed threshold value<sup>11</sup> of 0.9 (Chart 2.23).

**Chart 2.23: Financial Stress Indicator (with Projections upto August 2011 in Green)**



Source: RBI Staff Calculations

**Box 2.1 Algorithm trading / High Frequency Trading**

Trading in financial markets has changed substantially with the growth of new information processing and communications technologies over the last two decades. Algorithmic trading, in the context of trading on modern (electronic platform based) financial markets, refers to an automated trading process using computer programs (algorithms) for making certain trading decisions (timing, price, order - type and quantity), submitting and managing trading orders. In Algorithmic ('Algo') trading, traders connect their computers directly with trading systems of exchanges known as electronic communication networks (ECNs) or Smart Order Routing (SOR). A computer algorithm then monitors streaming price quotes and other relevant information on different ECNs and places orders without human intervention. High Frequency Trades are conducted in all asset classes - equities, derivatives, currency and fixed-income. According to some estimates, at present, HFT accounts for 70-80 per cent of trading volume in US and 40 per cent of trading volumes in Europe for equities.

The "flash crash" of May 6, 2010 is widely reported as a case that illustrates markets' vulnerabilities linked to HFT related

practices. The May 6, 2010 'flash crash', a stock market crash event, in which the Dow Jones Industrial Average (DJIA) fell about 900 points, is the second largest intraday point swing in its history. Though the Index recovered those losses within minutes, a joint report of the Securities Exchange Commission and the Commodity Futures Trading Commission detailed how the HFT systems started selling the E - Mini S&P 500 contracts aggressively, accelerating the effect of an unusually large sale by a mutual fund and contributing to the sharp price declines that day.

As compared to the developed markets (US and Europe), HFT is at an early stage in India but Algorithmic trading is picking up fast since the Securities and Exchange Board of India (SEBI) approved the use of Algotrading in April 2008. The National Stock Exchange (NSE) and the Bombay Stock Exchange (BSE) have invested in necessary technological platforms to facilitate HFT and have offered the 'co-location' facility (whereby the members can house their servers at / near the exchange's system-engine to save precious microseconds in execution of an order) to interested members.

<sup>10</sup> Source : Securities and Exchange Board of India

<sup>11</sup> An indicator is said to issue a signal of stress whenever it exceeds a given threshold level. Threshold levels are chosen so as to strike a balance between the risk of missing many crises and the risks of having many false signals. These risk situations would happen, respectively, if the signal is issued only when the evidence is overwhelming, and if a signal is issued at the slightest possibility of a crisis. If the threshold is too "tight" to reduce the number of false signals, the type I error (rejecting the null hypothesis of crisis when in fact there is a crisis) is large. In contrast, if the threshold is too "slack," i.e. too close to normal behaviour, it is likely to catch all the crises but it is also likely to announce many crises that never happened. In this case, the type II error (accepting the null hypothesis of a crisis when in fact there is none) will be large.



## Concluding Remarks

2.33 The macrofinancial environment for stability has improved in the last few months since the release of the previous FSR. There are, however, lingering concerns, some of which have aggravated since then. The sovereign debt situation in Europe appears to be spreading to the rest of the AEs which are bigger and have much greater systemic significance. Robust demand and growth in EMEs have strong structural and cyclical impetus to commodity prices but the increasing financialisation of commodity markets together with higher speculative interest might be distorting the tradeoffs between inflation and growth for many AEs and EMEs and escalating volatility. This in turn causes shocks from commodity markets to spread to other markets. If bond market sentiments were to turn, particularly, on fears of inflation, banking and financial institutions in AEs which are still recovering from the financial crisis could be hit hard. The impact of the two major systemic events of the period under review, *viz.* conflict in Libya

(and unrest in MENA) and the Japanese earthquake has been limited so far. If tensions in MENA continue or spill over into bigger economies in the region, the impact on Indian financial markets would be difficult to contain, particularly because India's fiscal improvement is expected to slow this year.

2.34 In India, the higher inflation and the attendant rate hikes have increased the attractiveness of overseas borrowing in terms of interest rate differential and availability of credit. Firms are exploring overseas markets to raise money even without offsets for the foreign currency liabilities that follow. Moreover, many of them face bunched up maturities on FCCBs in the next two years. The high and growing net external liability position of residents exposes the country to the risk of a sharp fall in the currency. Any potential adverse fallout of accommodative monetary policies pursued elsewhere need to be addressed with appropriate policy action.

## Chapter III

### Financial Institutions

*Banks in advanced economies continued to face sluggish credit growth apart from their insufficient capitalisation and weak funding positions that still seemed dependent on public support. The confidence in the banking system was also adversely impacted due to renewed sovereign risks, particularly in the Euro area. As against this, in India, banks remain well capitalised, with their asset quality and profitability showing considerable improvement over the previous year. There was robust revival in credit off take during 2010-11 compared to the subdued growth witnessed in 2009-10. Amid these developments, the upturn in credit growth called for caution as this is a phenomenon often synonymous with less stringent credit risk assessments and potential to contribute to asset impairments during the downturn of credit cycle. The fears of impending slowdown in the economy also raised the concern of sustainability of the credit growth even as monetary tightening and macroprudential measures to prevent overheating were underway. The liquidity position of the banks was adversely affected on account of growing mismatches in the growth rates of deposit and credit, apart from the other structural factors like gaps in the maturity profile of their assets and liabilities becoming bigger due to growing exposure to long term infrastructure projects. The Banking Stability Map, introduced in the previous FSR to indicate relative movements of select risk parameters of the banking system during a given period, indicated marginal increase in the risks pertaining to liquidity compared to the previous year. However, the Banking Stability Indicator, also introduced in the previous FSR, showed overall improved stability. In the co-operative sector, while the measures to consolidate and strengthen the urban co-operative banks continued, the number of unlicensed rural co-operatives entities came down as a result of steps initiated in this regard. The financial soundness indicators of rural cooperative credit institutions, however, remained a matter of concern. The non-banking finance companies showed improvement in their performance as a result of which their soundness indicators also improved. The regulatory architecture of these companies continued to be tightened with a view to plug regulatory gaps and prevent possible opportunities of regulatory arbitrage. Insurance sector has been covered for the first time in the FSR. Although, the insurance sector does not contribute to the systemic risk in the manner the banking sector does, it is a critical component of the financial system, being one of the key players in the financial markets. In India, the insurance sector has grown deep and wide over the years, particularly after opening up of the sector to the private players, and remains robust and well regulated.*

#### Post-crisis Global Scene

##### ***Sovereign and bank funding risks remain key sources of financial instability even as global system witnessed 'two speed recovery'***

3.1 The world economy is expected to grow at about 4.5 per cent during 2011 and 2012. As against this, the growth of advanced economies is expected to be only 2.5 per cent compared to the 6.5 per cent growth expected in case of emerging and developing economies (World Economic Outlook, IMF, April 2011). This 'two speed recovery' has thrown unique policy challenges for countries.

3.2 Sovereign balance sheets remained a key source of financial instability, especially because of their interconnectedness with banks. On the one hand, the concerns over the sustainability of public debt have been affecting the banks' balance sheet creating adverse feedback loops through real economy. On the other hand, the volatility in the Euro area markets emanating essentially from sovereign debt risks, has resulted in erosion of investors' demand making the task of sovereign funding quite uncertain apart from driving up sovereign yields and CDS spreads. Going forward, the most pressing challenge for the advanced economies is the funding of banks and sovereigns, particularly in

some vulnerable Euro area countries (Charts 3.1 and 3.2).

3.3 Segments of the global banking system remain vulnerable to further shocks. Despite improvements to balance sheets and significant policy initiatives, some banks remain insufficiently capitalised and vulnerable to rising funding costs, which was evident in the rising and elevated bank CDS spreads. Credit growth remained very subdued in the advanced economies despite the lending conditions having eased in the major advanced economies. As against this, credit growth reached high levels in many emerging market economies (EMEs), particularly in Asia and Latin America.

### Domestic Developments - Scheduled Commercial Banks (SCBs)

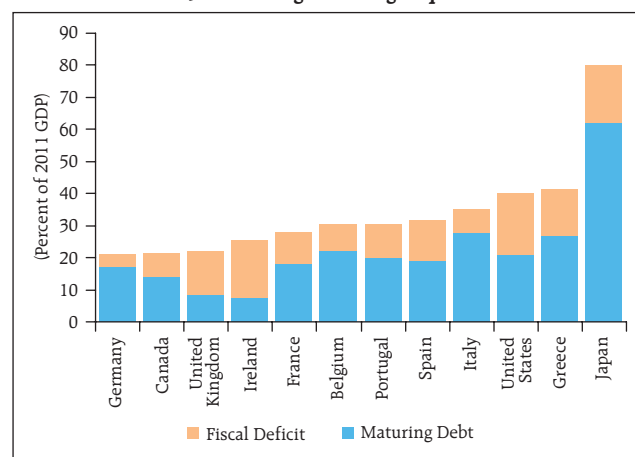
#### Balance Sheet

#### *Amid strong growth, some concerns owing to growing reliance on market funds to fund robust credit growth were discernible*

3.4 The balance sheet structure<sup>1</sup> of the SCBs remained robust. Deposits continued to dominate the liability side of the balance sheet while the profile of bank assets, essentially held as part of the banking book, also remained largely unchanged. However, certain concerns were discernible in the balance sheet structure, *viz.*, increased reliance on market borrowings to fund assets, increasing imbalances in the maturity profile of assets and liabilities and potential addition to asset impairments which could follow the rebound in credit off take.

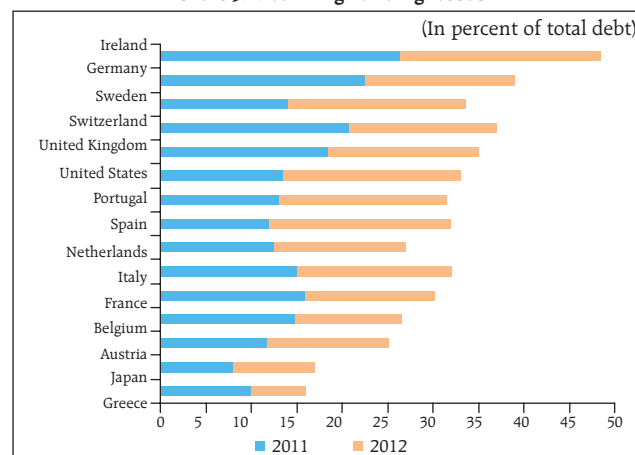
3.5 As at end March 2011, the balance sheet size of SCBs increased by about 19 per cent primarily on account of improved credit off take. The outstanding credit had grown by 22.6 per cent during the year (17 per cent in the previous year) (Chart 3.3). As against this, deposits lagged behind with growth of 18 per cent. The gap was funded by increase in funds accessed from market (CD issuances and borrowings) which increased by 34.5 per cent over its position as at end March 2010. The share of borrowings and CDs in banks' liabilities

Chart 3.1: Sovereign Funding Requirements



Source: GFSR, April 2011

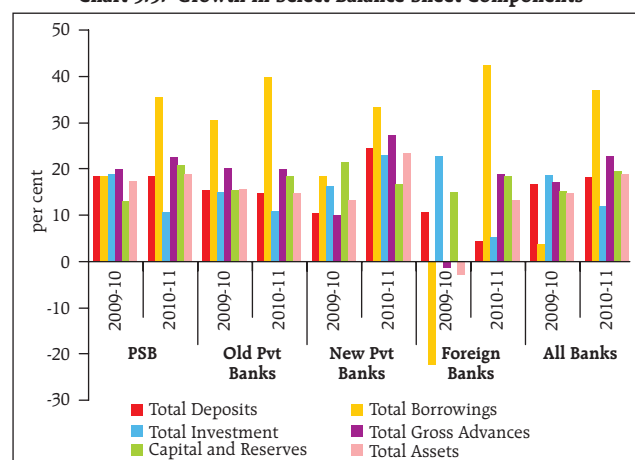
Chart 3.2: Banking Funding Needs



Source: GFSR, April 2011

Note: The data are for a sample of banks in each country.

Chart 3.3: Growth in Select Balance Sheet Components



Source: RBI supervisory returns

<sup>1</sup> Deposits comprise about 79 per cent of total liabilities and the credit portfolio (advances and investments) constituted about 87 per cent of the assets, the investments being about 30 per cent of the total assets.

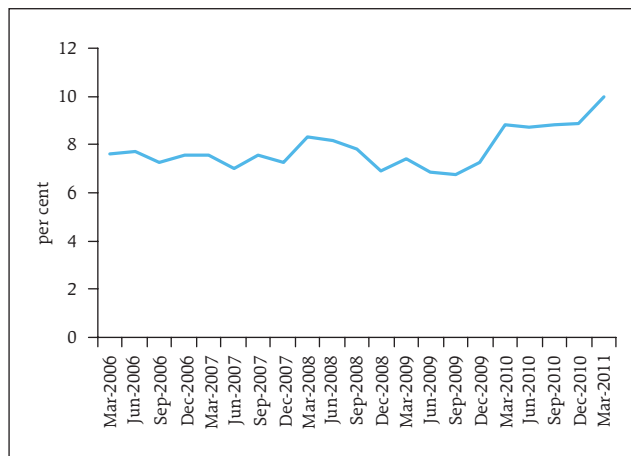
rose to about 10 per cent in 2011 from about 7.5 per cent in 2006 (Chart 3.4).

3.6 The increased reliance of banks on borrowed funds raised concerns about their liquidity position, especially if such reliance were to increase further. These concerns were further accentuated by a reduction in the share of liquid assets in the total assets of the banks (Chart 3.5). In particular, the period from October 2010 to February 2011, during which the systemic liquidity conditions were strained, witnessed increased CD issuances with interest rates rising to 9-10 per cent. Increase in borrowings from market was particularly evident in the case of public sector banks (PSBs) and new private sector banks.

3.7 Concerns about increasing reliance on borrowed funds were further exacerbated by growing mismatches in the maturity profile of deposits and advances. While more deposits than advances were getting re-priced in the near term (less than a year) bucket, more advances than deposits were maturing in 1-3 year and 3-5 years buckets (Chart 3.6). These mismatches entailed considerable rollover risks for banks.

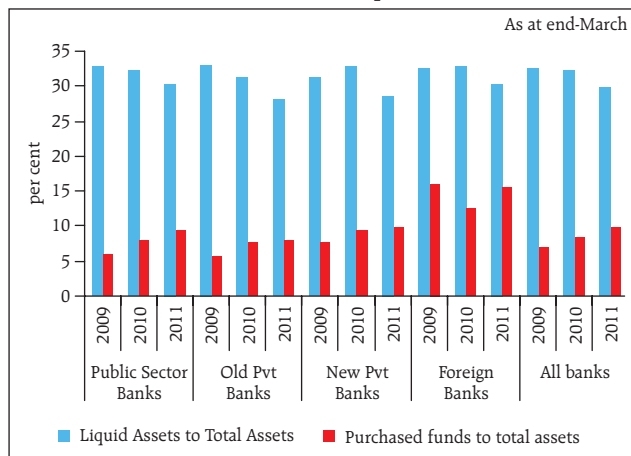
3.8 At the current juncture, however, the reliance on market borrowings was not very significant in absolute terms. Also, concerns were alleviated by the accessibility of banks to stable low cost deposits (current account and savings account - CASA deposits) which stood at about 35 per cent of total deposits (Chart 3.7).

Chart 3.4: Share of CDs and Borrowings in Liabilities



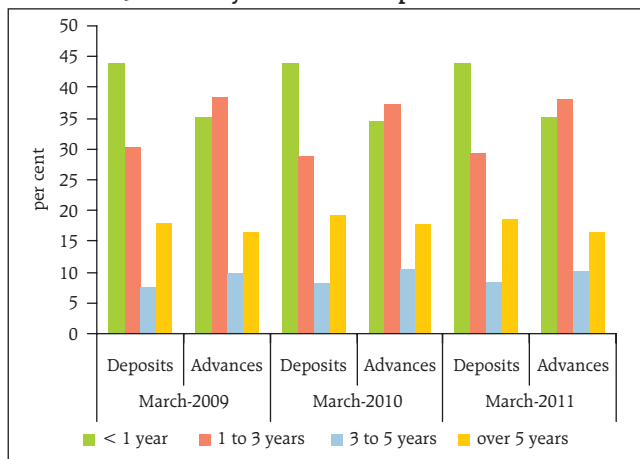
Source: RBI supervisory returns

Chart 3.5: Level of Liquid Assets



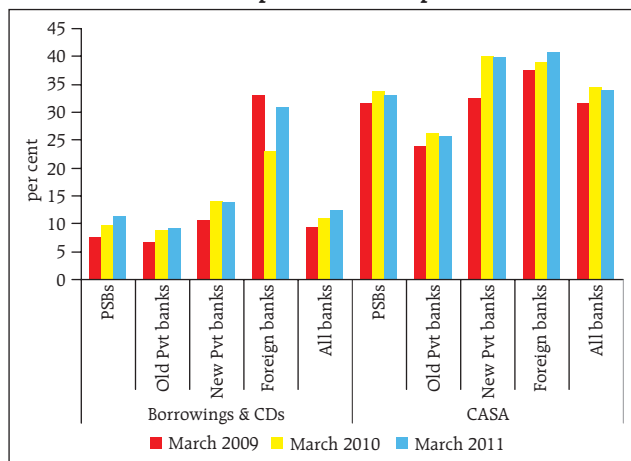
Source: RBI supervisory returns

Chart 3.6: Maturity Profile of the Deposits and Advances



Source: RBI supervisory returns

Chart 3.7: Ratio of CDs and Borrowings and CASA Deposits to Total Deposits



Source: RBI supervisory returns

## Credit Growth

### *Credit growth revived; nonetheless caution was called for to ensure quality of assets*

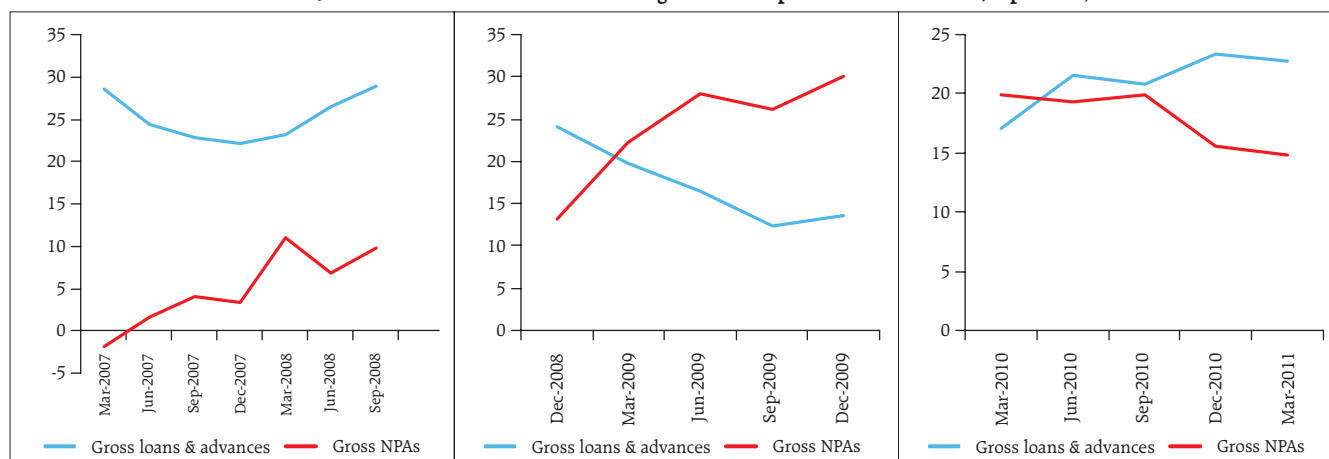
3.9 Credit growth rebounded in 2010-11 with 22.6 per cent growth in outstanding credit after a subdued performance in the previous year. The robust growth in credit was a necessity in a developing economy like India for sustaining high GDP growth and improving the level of financialisation of the country (credit to GDP ratio stood at about 73 per cent as at end December 2010). Simultaneously, however underwriting standards would need to be tightened in order to ensure that the quality of credit does not deteriorate, going forward.

3.10 To assess the impact of credit growth in India on banks' asset quality, an empirical study was conducted to analyse the related trends in the periods identifiable with pre-global financial crisis, its aftermath and the post crisis phase. The study revealed that strong credit growth was synonymous with lowering of the risk perceptions leading to perceptible improvement in asset quality, whereas slow down in credit growth was followed by increase in impaired assets (Chart 3.8). During March 2007 - September 2008, while the outstanding credit growth remained relatively high at about 24 per cent, NPAs had either decelerated or grew

by less than 10 per cent (left pane), as against which during the slow down phase (middle pane) when the credit off-take started declining and fell to 12-13 per cent in December 2009, the growth in NPAs rose from about 13 per cent in December 2008 to 30 per cent in December 2009. The credit growth during 2010-11, seemed comparable to the growth witnessed in pre-crisis period. It was also being seen that there was substantial deceleration in growth of NPAs (right pane). Apart from reflecting cyclicity, the pattern was also indicative of impairment in assets being actually initiated during phases of rapid credit growth. Increased caution in credit selection and stringent monitoring standards would thus be necessary to ensure that the credit growth remained immune to potential impairments, should a slow down were to take place.

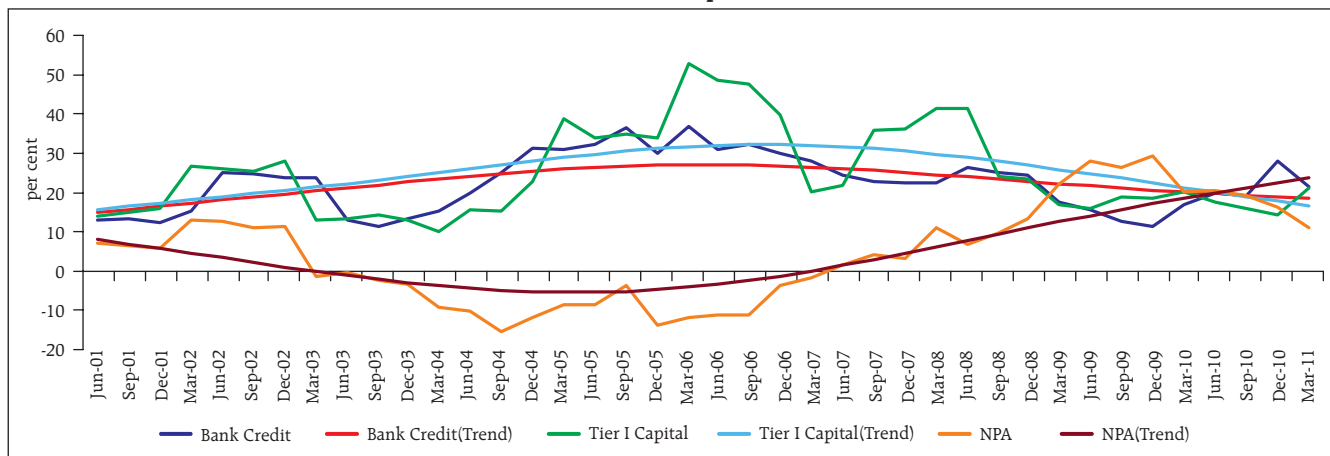
3.11 An analysis of growth in outstanding credit, gross NPAs and Tier-I capital funds over the past one decade also revealed similar trends. The analysis additionally revealed that growth in capital funds was above (below) its long term trend when credit growth exceeded (fell short of) its long term trend. Thus, the phases of robust credit off take warranted close monitoring as these could be precursors to future asset impairments and reductions in capital levels during the downturn of the credit cycle (Chart 3.9).

Chart 3.8: Growth of Credit and NPAs during Phases of Upturn and Downturn (in per cent)



Source: RBI supervisory returns and RBI staff calculations

Chart 3.9: Growth in Credit, NPAs and Tier-I Capital Funds vis-a-vis their Growth Trend



Source: RBI supervisory returns and RBI staff calculations

3.12 The periods of high credit growth have the potential to give rise to credit boom like scenarios (Box 3.1), which have often been identified to be precursors to credit busts and financial crises. However, devising methods to get a reliable estimate of overheating in the system due to high credit growth is

difficult as different economies, based on their stages of development, pose critical limitations to usefulness of these methods. As discussed in Chapter IV, one such method which attempts using the trend of credit to GDP ratio to determine overheating, could not give any reliable estimate.

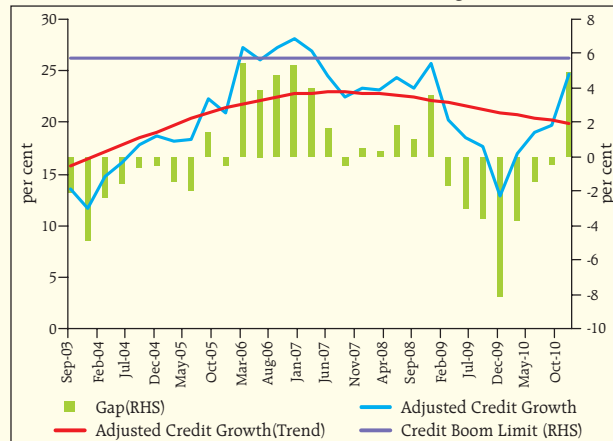
Box 3.1: Are We Witnessing a Credit Boom?

It is widely believed that phases of credit booms preceded majority of financial or banking crises. In an analysis of the financial crises in the past, and episodes of credit booms as defined by Mendoza and Terrones, it was observed in a BIS paper (BIS Quarterly review, September 2010) that there were 17 episodes of financial crises which were preceded by credit booms in a sample of 27 such crises.

Such phases of excessive credit booms have been defined to be happening when the cyclical component of credit exceeds the average historical cyclical component by 1.75 times the standard deviations of the credit variable. Based on this definition, lower limit for credit boom has been estimated and presented in the Chart 3.10. It may be observed from the chart that in India, during the period under analysis, cyclical component of credit growth has never crossed the lower limit, nonetheless, during the period between March 2006 and March 2007, it may have come quite close to the limit. Hence, based on this definition, it appeared that the country might have witnessed a near credit boom during the stated period. This period indeed preceded the period of slower growth in credit and higher growth of NPAs in the banking system. The chart also showed that such a credit growth may have taken place during 2010-11 as the cyclical component reached close to the aforesaid limit.

The above study is of considerably greater relevance for developed economies. For developing economies like India, however, it has limitations where robust credit growth is a necessity for financing higher economic growth. Nevertheless,

Chart 3.10: Credit\* Growth vis-à-vis its Long term Trend



\* Credit (private) pertains to advances outstanding with SCBs, UCBs, NBFCs and excludes credit to Govts. and PSUs.  
Source: RBI supervisory returns and RBI staff calculations

measuring credit booms in developing economies like India, may be helpful in identifying such periods which witnessed strong credit growth and, as discussed in para 3.10 and 3.11 of this Chapter, were followed by greater growth in impaired assets. It may also signal the need for cautious credit selection, strategic limit to concentration risks in the specific sectors driving the growth, more strict monitoring of accounts to ensure that credit quality did not suffer in the wake of improved credit growth, apart from holding adequate capital and providing more towards potential accretions to NPAs.

**Exposure to specific sectors have driven the credit growth**

3.13 The credit portfolio of SCBs was well diversified across industries, geography and sectors. However, during the last few years, incremental credit growth was observed to be mainly propelled by credit growth in a few sectors *viz.*, retail, commercial real estate and infrastructure. In March 2011, these sectors accounted for 19 per cent, 4 per cent and 13 per cent respectively of the gross advances of the SCBs (Chart 3.11). The combined contribution of the three sectors to the incremental gross outstanding credit was to the extent of 40 per cent. Their combined exposure registered an increase of 27.5 per cent during 2010-2011 as against 20.4 per cent in 2009-2010 (Chart.3.12). The PSBs and new private sector banks showed the maximum increase (27.9 per cent and 30.6 per cent respectively).

3.14 Each of these sectors were characterised by unique asset quality features and, given their large share in credit portfolio of banks, required careful monitoring.

**Sectoral Credit and their Asset Quality**

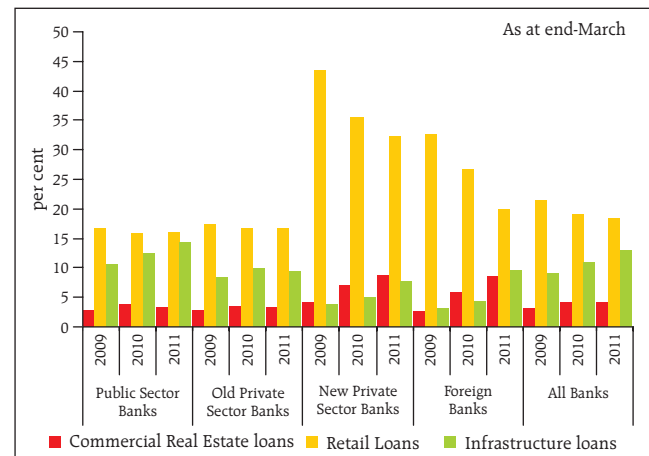
**Real Estate**

**Incremental share in both credit and impaired assets remained large**

3.15 Real estate loans constituted 17.7 per cent of gross advances in March 2011, the share being nearly 30 per cent in case of new private sector and foreign banks. The credit to the sector registered a growth of 24.6 per cent in 2010-11, *i.e.* at a rate higher than the overall credit growth of 22.6 per cent. In the preceding two years, the rate of growth of loans to this sector was 17 per cent and 11 per cent respectively (Charts 3.13 and 3.14).

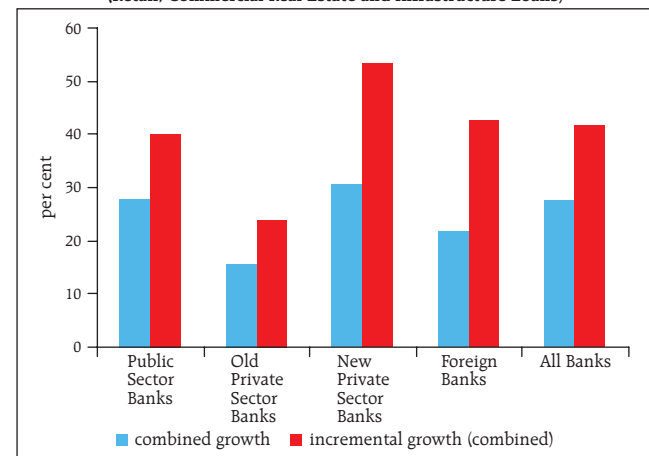
3.16 Residential mortgages and the commercial real estate - the two major segments of the real estate sector - both registered a growth rate of about 24 per cent. The new private sector and foreign banks increased their commercial real estate exposure by 59 and 69 per cent respectively, a rate much higher than the single digit growth rate witnessed by the other two bank groups. The rate of growth of NPAs in this segment at 19.8 per cent was also higher than the overall NPA growth rate

**Chart 3.11: Share of Loans to Commercial Real Estate, Retail and Infrastructure in Gross Credit**



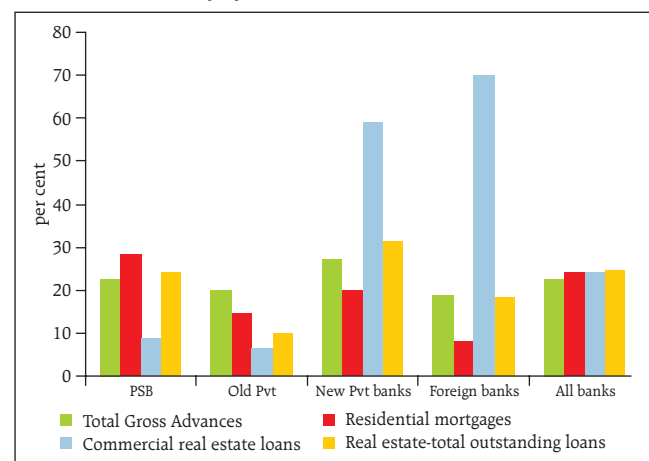
Source: RBI supervisory returns

**Chart 3.12: Growth of Combined Exposure (Retail, Commercial Real Estate and Infrastructure Loans)**



Source: RBI supervisory returns

**Chart 3.13: Growth in Real Estate Loans**



Source: RBI supervisory returns

of 14.8 per cent. In particular, the NPAs in the commercial real estate segment grew at 70.3 per cent as at end March 2011, most of the impairment taking place in PSBs.

3.17 The share of real estate NPAs in the gross NPAs of the banking sector stood at 15 per cent - lower than the share of sector's credit in total credit at 17.7 per cent. The gross NPA ratio at 1.8 per cent was also lower than the overall NPA ratio of 2.3 per cent for SCBs. The NPA ratio improved for residential mortgage loans (2.5 to 2.2 per cent), though it deteriorated in the case of commercial real estate loans (1.6 to 2.3 per cent) (Chart 3.15).

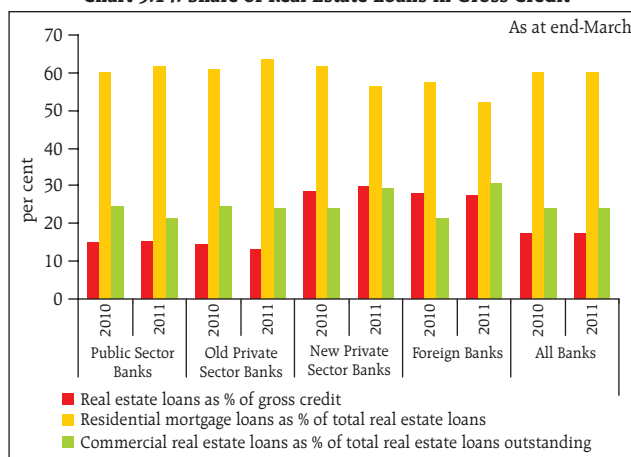
3.18 Despite the positive developments mentioned above, the real estate sector posed some concerns given the large and growing share of these loans in the credit portfolio of banks, its NPAs witnessing higher than system level NPAs growth, and potential of greater slippages into NPAs.

3.19 Going forward, the asset quality in this segment may come under further pressure given the increasing interest rate environment<sup>2</sup>. There is also some anecdotal evidence of increasing inventory levels in the sector even as prices continued to remain elevated. In view of these developments, the Reserve Bank announced a series of macroprudential measures, *inter alia*, to curb excessive leveraging in the sector and strengthen resilience of the banking system<sup>3</sup>.

**Retail credit staged a comeback having declined in the previous year**

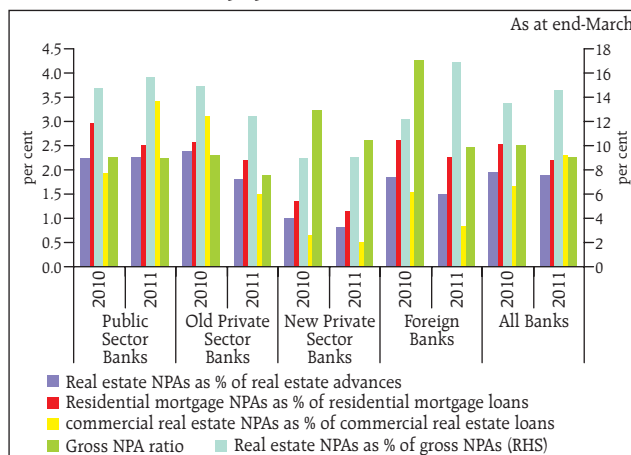
3.20 Credit to the retail sector accounted for 18.5 per cent of the gross loans and advances of SCBs as at end March 2011, marginally lower than 19 per cent in March 2010 (Chart 3.16). Retail loans grew by 19 per cent during 2010-11, rebounding strongly after a 3 per cent growth in 2009-10. The bulk of the increase was attributable to the personal loan segment which primarily comprised

Chart 3.14: Share of Real Estate Loans in Gross Credit



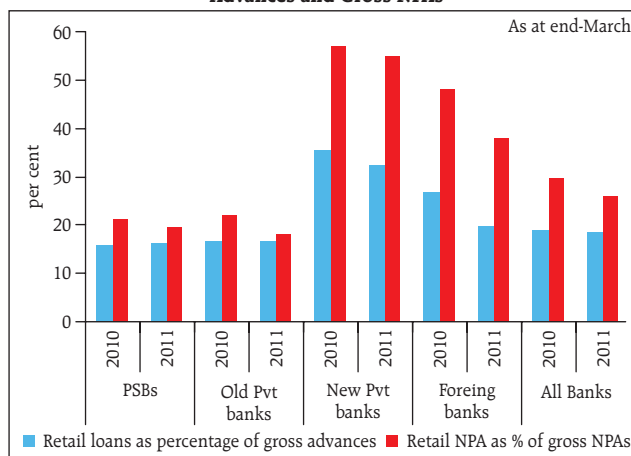
Source: RBI supervisory returns

Chart 3.15: Real Estate NPA Ratios



Source: RBI supervisory returns

Chart 3.16: Share of Retail Loans and its NPAs in Gross Advances and Gross NPAs



Source: RBI supervisory returns

<sup>2</sup> Monetary tightening to address inflationary conditions has resulted in raising reference rates nine times, from 4.75 to 7.25 per cent (repo rate) between March 2010 – May 2011. Increase in the base rates of select banks was in the range of 1.25 to 2.0 per cent during the same period.

<sup>3</sup> Reserve Bank announced a series of measures in the Second Quarter Review of Monetary Policy in November 2010 which included, *inter alia*, restriction on Loan to Value ratio of housing loans to 80 per cent (90 per cent for loans up to ₹20.00 lakh) to prevent excessive leveraging and increase in the risk weights on large housing loans (₹ 75 lakh and above) to 125 per cent, increase in standard asset provisioning on the outstanding amount of loans with 'teaser' interest rates from 0.40 per cent to 2.00 per cent etc.



riskier, unsecured loans (Chart 3.17). As on March 2011, 31 per cent retail loans were unsecured, with this segment registering an increase of 24.9 per cent during the year.

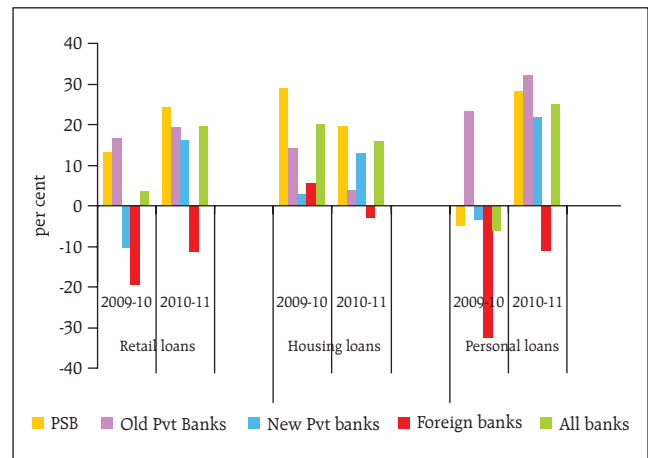
3.21 The gross NPA ratio of retail loans at 3.2 per cent remained higher than the overall NPA ratio of 2.3 per cent for SCBs. However, the quantum of retail NPAs showed decline of 2.2 per cent during 2010-11 as against decline of about 7 per cent in 2009-10 (Charts 3.18 and 3.19). The quantum of housing loan NPAs also declined though there was a marginal increase in case of personal loan NPAs.

3.22 The robust rebound in retail loans witnessed during recent quarters warrants close monitoring as the asset quality of such loans could come under pressure given the increasing interest rate environment. The performance of these loans are closely linked to the individual income and wealth levels, which could be affected if the risks to economic growth, as discussed in Chapter I of this Report, were to materialise.

**Infrastructure credit grew robustly, so did the sector's impaired assets; gross NPA ratio in the sector, however, remained low**

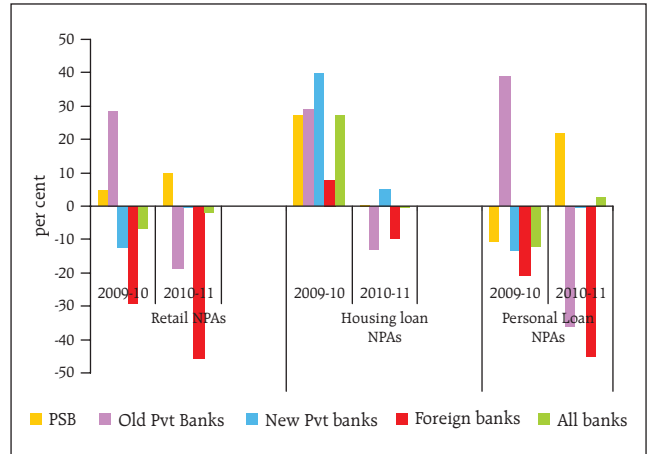
3.23 Advances to infrastructure continued to exhibit strong growth of above 40 per cent in 2010-11 (Chart 3.20). The share of infrastructure lending in total advances consequently increased to 12.9 per cent in March 2011 as against 11 per cent in March 2010. Among the bank groups, the exposure was concentrated in PSBs

Chart 3.17: Growth in Housing and Personal Loans



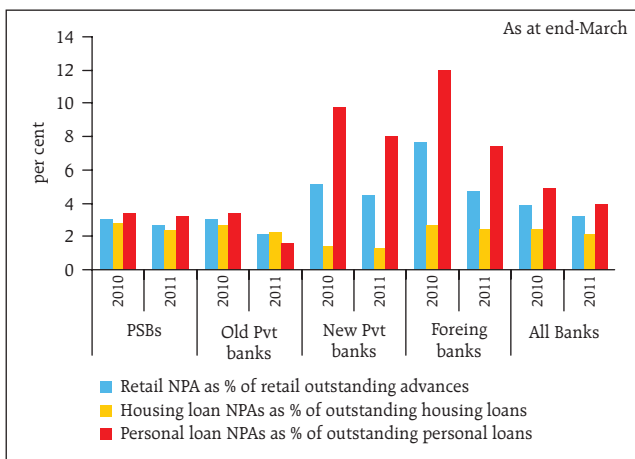
Source: RBI supervisory returns

Chart 3.18: Growth in Retail Loan NPAs



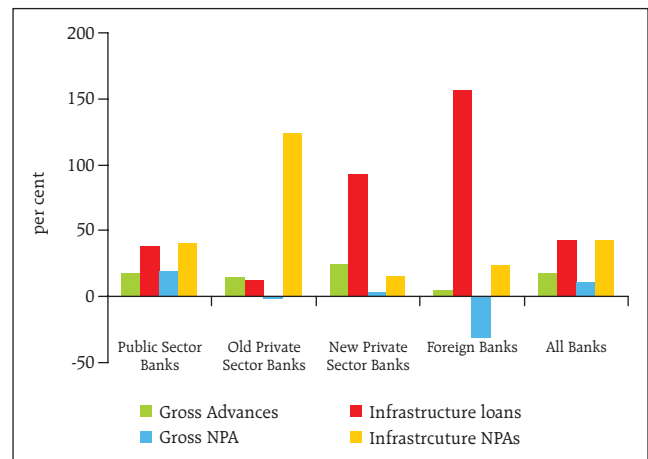
Source: RBI supervisory returns

Chart 3.19: Ratio of Retail Loan NPAs



Source: RBI supervisory returns

Chart 3.20: Growth of Infrastructure Loans and its NPAs



Source: RBI supervisory returns

which accounted for 84.8 per cent of the total banking sector's exposure to the segment.

3.24 There was an increase of 42.5 per cent in impaired infrastructure loans during 2010-11. Nevertheless, the gross NPA ratio for such loans continued to be low at around 0.5 per cent.

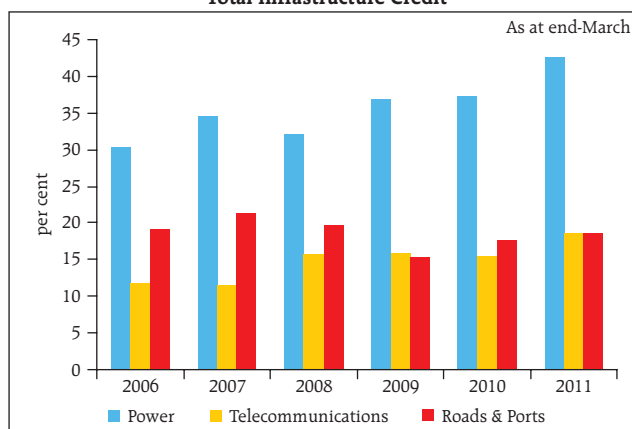
3.25 Banks' exposure to power, telecommunications and roads and ports formed the important segments of infrastructure credit. Credit to the power sector accounted for about 42 per cent of aggregate infrastructure credit while the other two segments accounted for 18 per cent each (Chart 3.21). During the last five years, SCBs' exposure to the power sector grew at an average of 50 per cent whereas large fluctuations were witnessed in the growth rate of credit to other two sectors (Chart 3.22). Gross NPA ratios in the different segments of infrastructure credit fluctuated over the years but remained well below the overall NPA ratio for the SCBs (Chart 3.23).

3.26 The previous FSR stated that increased exposure to the infrastructure segment could heighten asset liability management (ALM) risks for banks. These risks have been accentuated with the increased share of infrastructure credit in the total advances of SCBs. The asset liability management issues associated with infrastructure lending could also potentially get exacerbated given the not insignificant probability of projects getting delayed, as pointed out in the previous FSR. All of this underscores the urgent need for evolving a long term funding market for infrastructure projects.

**Concentration in high risk industries was low**

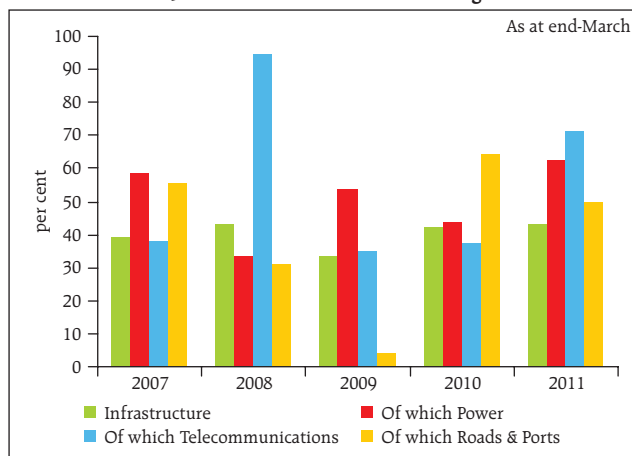
3.27 A study of deployment of bank credit in thirty eight major industries was done to assess the concentration in high risk industries and the underlying trends<sup>4</sup>. Over the period spanning the last six years, the share of credit to high risk industries has remained low though there was some increase noticed in the aftermath of the crisis. As on March 2011, the share of such credit stood at around 16 per cent. There were, however, some outlier banks whose share in high risk

**Chart 3.21: Share of Important Infrastructure Segments in Total Infrastructure Credit**



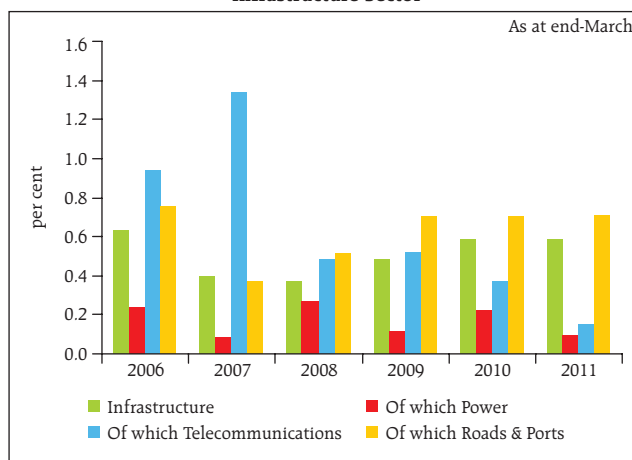
Source: RBI supervisory returns

**Chart 3.22: Growth in Infrastructure Segments**



Source: RBI supervisory returns

**Chart 3.23: Ratio of NPAs in Banks' Exposure to Infrastructure Sector**



Source: RBI supervisory returns

<sup>4</sup> Risk categorization of various industries is based on CRISIL industry risk scores for the periods while data for banking sector as on March 2011 has been used from Reserve Bank sources.

industries exceeded the industry average (Charts 3.24 to 3.25).

**Exposure to Priority Sector<sup>5</sup>**

***Exposure to the priority sectors increased but high level of NPAs were a cause for concern***

3.28 Priority sector credit grew by 21 per cent during 2010-11 as against which its impaired assets increased by 28 per cent. Thus, asset quality of exposures to the priority sector, especially agriculture, continued to compare unfavourably with the overall NPA ratio of the banking sector. Consequently, the gross NPA ratio for the sector deteriorated from 3.3 per cent to 3.5 per cent (Chart 3.26).

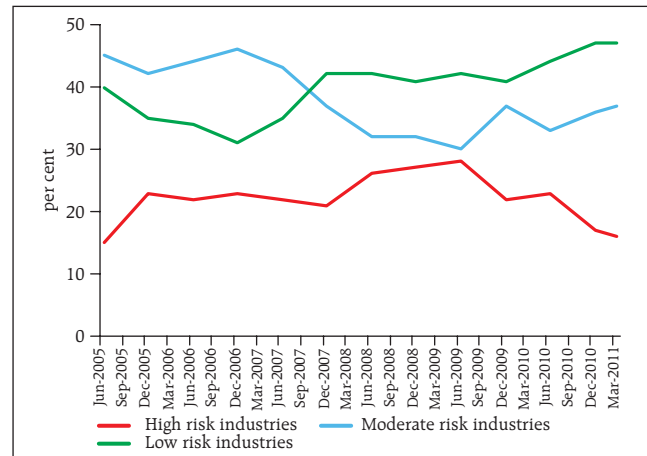
3.29 The gross NPA ratio in respect of credit to the agriculture segment rose to 3.3 per cent in March 2011 as against 2.4 per cent in March 2010. The deterioration in the ratio was attributable to a rise of 60 per cent in agriculture NPAs as against a growth of 19 per cent in agriculture credit. The gross NPA ratio of the micro and small enterprises (MSE) was also high at 3.5 per cent with gross NPAs increasing by 18.4 per cent over high accretions of the previous year. In order to address entire gamut of issues involved with lending to the priority sector, a Committee is being constituted by the Reserve Bank to relook at the definition of the priority sector, especially in cases where bank finance was being routed through other institutions.

**Off-balance Sheet (OBS) Exposure**

***Significant increase was noticed in foreign banks' OBS exposure***

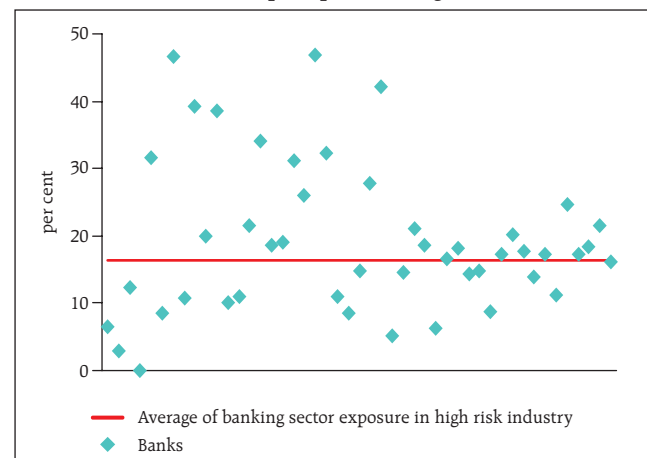
3.30 Aggregate notional amount of OBS exposures of the SCBs as a percentage of their total balance sheet size increased from 178 per cent as at end March 2010 to 198 per cent as at end March 2011. In the case of foreign banks, OBS exposure as proportion of their on-balance sheet exposure increased from 1554 per cent to 1860 per cent during the year.

**Chart 3.24: Risk-wise Distribution of Bank Credit to Industries**



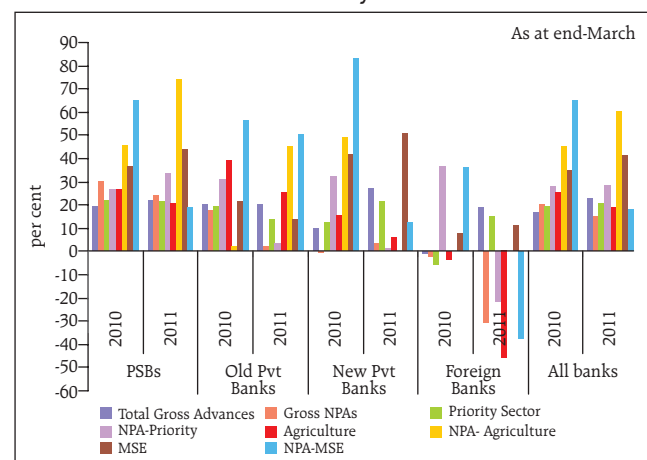
Source: RBI

**Chart 3.25: Bank Groups' Exposure to High Risk Industries**



Source: RBI staff calculations

**Chart 3.26: Growth in the outstanding exposure and NPAs in Priority Sectors**



Source: RBI supervisory returns

<sup>5</sup> Priority sector credit is an arrangement of directed bank credit to such needy sectors which are worse off in absence of mandated channelisation of bank credit. Besides ensuring the growth of the financial sector, banks have been assigned a special role in the economic development of the country, with certain proportion of credit being directed to priority sectors like agriculture, MSE, education, housing, micro credit, weaker sections of population, etc.

3.31 The notional principal of these exposures increased by 32.3 per cent during the year as against decline of 5.8 per cent in the previous year (Chart 3.27). The distribution of the aggregate notional amount of OBS exposures among the bank groups showed concentration of about 68 per cent in foreign banks and just about 15 per cent each in case of PSBs and new private sector banks (Chart 3.28).

3.32 Credit equivalent of the derivative exposures, as a ratio of balance sheet size remained low and, in fact, exhibited a declining trend (from 8.8 per cent in March 2009 to 5.3 per cent in March 2010 and further to 4.5 per cent as at end March 2011). The ratio in case of foreign banks was higher at 51 per cent in March 2010 but declined to 47 per cent as at end March 2011. The aggregate mark-to-market (MTM) positions of the SCBs remained positive.

3.33 Among the OBS constituents, credit contingent deals as proportion of OBS exposure declined as at end March 2011 while the share of derivative deals, especially the foreign exchange contracts increased, warranting increased vigilance on this front (Chart 3.29).

3.34 OBS exposures in India generally comprise simple products/deals. Forward contracts form the bulk of foreign exchange contracts and are generally hedged back-to-back by the banks. There are, however, associated credit risks in forward contracts and in OTC interest rate deals which warrant vigilant risk management.

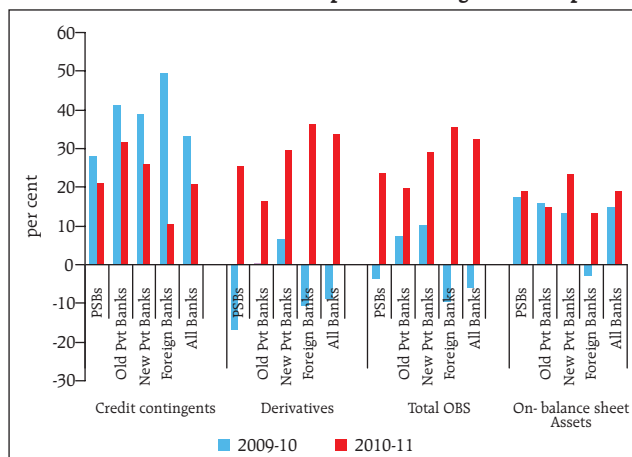
**Financial Soundness Indicators**

**Capital to risk weighted assets ratio (CRAR)**

*Banks remain well capitalised, though improved credit off take resulted in marginal decline in the capital adequacy ratio*

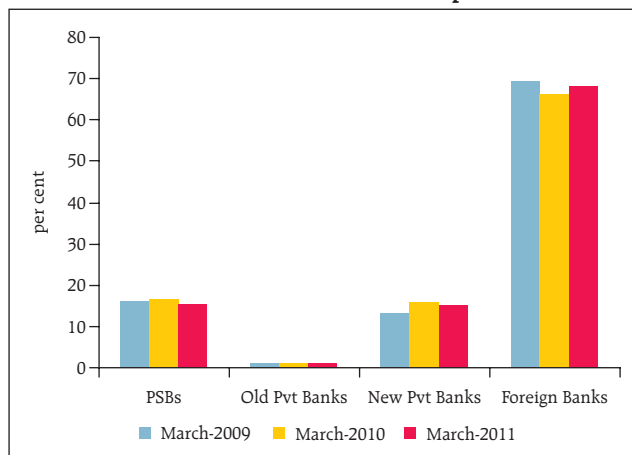
3.35 SCBs remained well capitalised as at end March 2011. The system level CRAR under Basel-II norms stood at 14.3 per cent which was well above the regulatory minimum of 9 per cent. There was, however, a minor decline compared to the CRAR of 14.5 per cent as at

**Chart 3.27: Growth in OBS Exposures among Bank Groups**



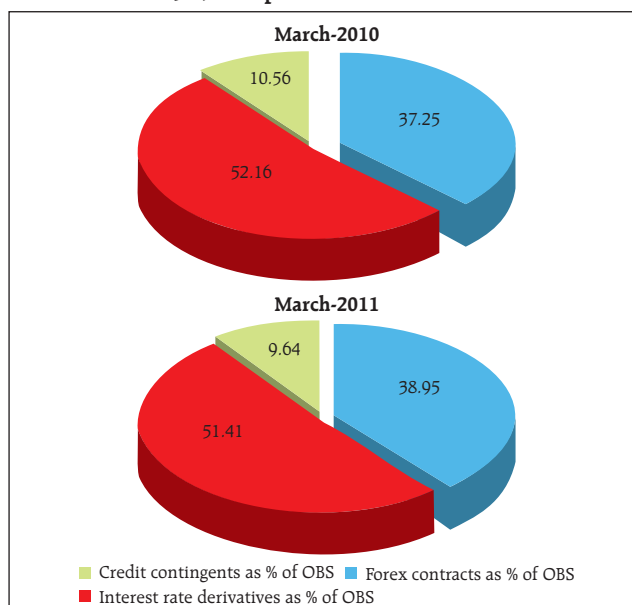
Source: RBI supervisory returns

**Chart 3.28: Distribution of OBS Exposure**



Source: RBI supervisory returns

**Chart 3.29: Composition of OBS' Constituents**



Source: RBI supervisory returns

end March 2010, largely due to robust credit off take during 2010-11. All the bank groups had CRAR above 12 per cent as at end March 2011 under Basel-II norms. Under Basel-I norms, however, the CRAR for PSBs at 11.9 per cent was marginally lower than 12 per cent (Chart 3.30).

3.36 The regulatory tightening of the capital requirements in India, especially with regard to core capital, preceded the Basel-III stipulations as the banks were required to maintain Tier I capital ratio of 6 per cent on a continuous basis with effect from April 01, 2010. Resultantly, as at end March 2011, core CRAR was comfortably above 6 per cent, for the banking system, each bank group as well as for individual banks (Table 3.1). Going forward, as the Basel III norms are introduced, some banks may need to raise additional capital especially if credit off take remains robust, as discussed in Chapter IV of this Report.

### Leverage Ratio

#### *Leverage ratio of banks in India remained comfortable*

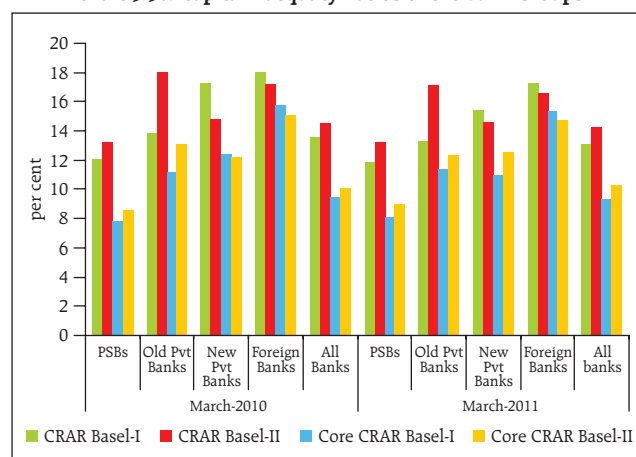
3.37 In an attempt to increase the systemic resilience by strengthening capital standards at individual bank level, Basel III regulatory capital framework has introduced a non-risk-based leverage ratio as a backstop to the risk-based capital requirement. It is proposed to test a minimum Tier I leverage ratio of 3 per cent beginning 2013 capturing both on and off balance sheet exposures. Leverage ratio of SCBs in India remained comfortable at about 6 per cent as at end March 2011 (Chart 3.31). Most banks individually operated with Tier I leverage ratio of greater than 4 per cent (only one bank had leverage ratio not greater than 3 per cent).

### Overall Asset Quality

#### *Asset quality impairments decelerated, though risks of further slippages remain*

3.38 Gross NPAs for SCBs increased by 14.8 per cent in 2010-11 as against 19.9 per cent in 2009-10. Given the higher growth rate of advances at 22.6 per cent, the gross NPA ratio improved from 2.5 per cent to 2.3 per cent. Net NPAs for SCBs improved to 0.9 per cent from

Chart 3.30: Capital Adequacy Ratios of the Bank Groups



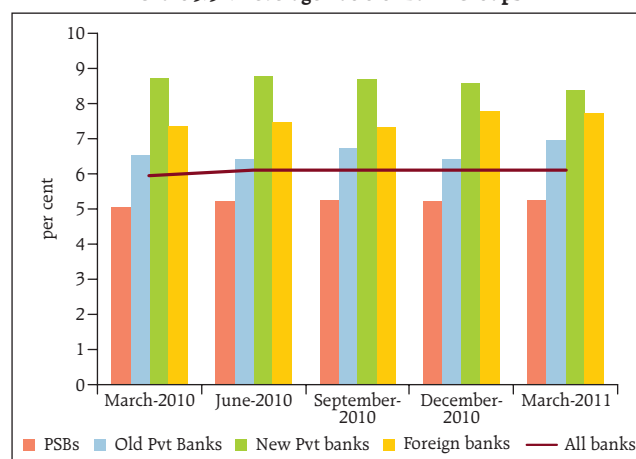
Source: RBI supervisory returns

Table 3.1 Distribution of SCBs' CRAR and Core CRAR

|                            | 2010 | 2011 |
|----------------------------|------|------|
| <b>CRAR</b>                |      |      |
| > 3 per cent <= 6 per cent | -    | -    |
| >6 per cent <= 9 per cent  | 1    | -    |
| >9 per cent <=12 per cent  | 2    | 6    |
| >12 per cent               | 79   | 75   |
| <b>core CRAR</b>           |      |      |
| upto 3 per cent            | -    | -    |
| >3 and <=6 per cent        | 1    | -    |
| > 6 per cent <=8 per cent  | 9    | 2    |
| > 8 per cent               | 72   | 79   |

Source: RBI supervisory returns

Chart 3.31: Leverage Ratio of Bank Groups



Source: RBI supervisory returns

1.1 per cent (Chart 3.32). The increase in gross NPAs was higher in the case of PSBs (at 23 per cent) against an increase of less than 5 per cent for the private sector banks and a decline of 30 per cent in case of foreign banks (Chart 3.33). Going forward, however, banks may possibly face some further deterioration in asset quality if credit growth slows down, as discussed in paragraph 3.10 of this Chapter.

3.39 The reduction in the growth rate of NPAs was, to some extent, due to write-offs of NPAs in addition to recoveries, though both had declined marginally as at end March 2011. The amount involved in the write-offs stood at 87 per cent of recoveries (97 per cent in 2009-10) and 20 per cent of outstanding credit (28 per cent in 2010). Clearly, in the absence of such write-offs, the position of gross NPAs would be much higher than is reported currently.

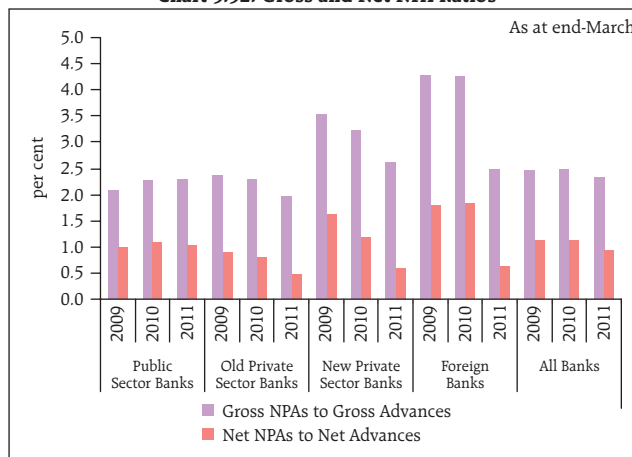
**Additions to restructured accounts have fallen**

3.40 The previous FSR discussed the one-time special dispensation in restructuring norms permitted by the Reserve Bank in 2008-09 for entities temporarily affected by the financial crisis. Standard assets to the extent of about 3 per cent of outstanding amount were restructured under the special dispensation during 2008-09 and 2009-10. The increase in the amount of restructured assets was 192 per cent and 60.2 per cent respectively during the two years. After the expiry of the currency of the special dispensation, instances of such restructuring declined sharply and an increase of only 10.7 per cent in restructured accounts was observed.

**While slippages improved, in case of PSBs it remained above the system average**

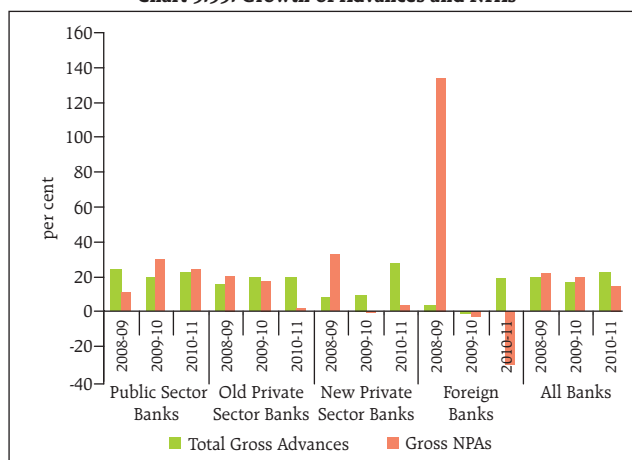
3.41 The slippage ratio, which is a measure of fresh accretion to the stock of NPAs as a percentage of standard advances at the beginning of the year, improved from 2.2 per cent as at end March 2010 to 1.6 per cent as at end March 2011 as the rate of growth of NPAs decelerated to 14.8 per cent (Chart 3.34). The ratio in case of PSBs, at 1.7 per cent, was marginally higher than the industry average.

Chart 3.32: Gross and Net NPA Ratios



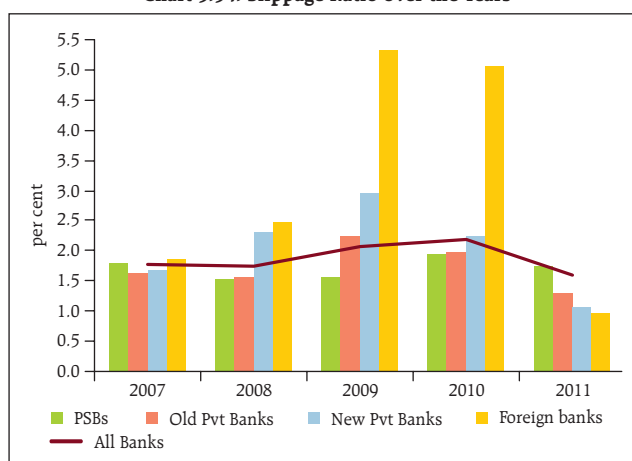
Source: RBI supervisory returns

Chart 3.33: Growth of Advances and NPAs



Source: RBI supervisory returns

Chart 3.34: Slippage Ratio over the Years



Source: RBI supervisory returns

### ***Increase in stickier NPAs was observed***

3.42 The change in category-wise distribution of NPAs during the year revealed an increase in doubtful assets *vis-à-vis* sub-standard assets, indicating that NPAs were becoming increasingly stickier. The trend was even more pronounced in case of new private sector banks which warranted monitoring (Chart 3.35).

### **Provisioning Coverage Ratio**

#### ***Macro-prudential measure to act as cushion against slippages***

3.43 In December 2009, banks were advised to achieve a provisioning coverage ratio (PCR) of 70 per cent of their non-performing advances by end September 2010. As on March 31, 2011, the private sector and foreign banks had maintained the required ratio though the PCR was just below 70 per cent in case of the nationalised banks. In case of the SBI group, the gap<sup>6</sup> was relatively higher (Chart 3.36).

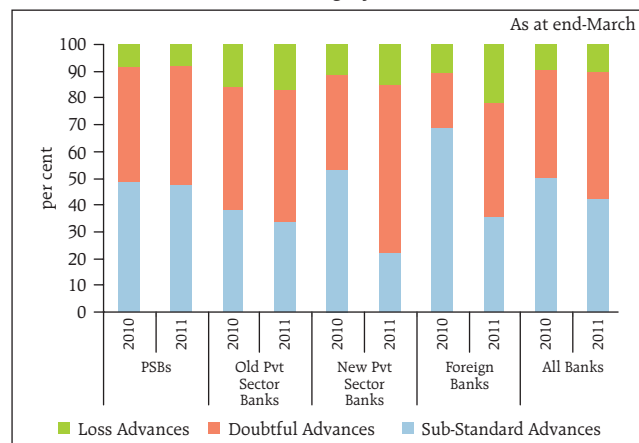
3.44 Keeping in view the sharp uptrend of credit growth in 2010-11, the Reserve Bank announced further macro-prudential measures in April and May 2011. Banks were advised to segregate the surplus of provisions under the PCR *vis-à-vis* the provisions required as per prudential norms as on September 30, 2010, into an account styled as 'counter-cyclical buffer'. The buffer would be available to banks for making specific provisions during economic downturns. Accordingly, banks were no longer required to maintain 70 per cent PCR on the incremental advances after September 2010. Simultaneously, the provisioning requirements on impaired assets were also enhanced on certain categories of non-performing and restructured advances<sup>7</sup>.

### **Profitability**

#### ***Robust growth in profitability was sign of improved performance. Little growth in non-interest income and rise in staff expenses, however, posed some challenge***

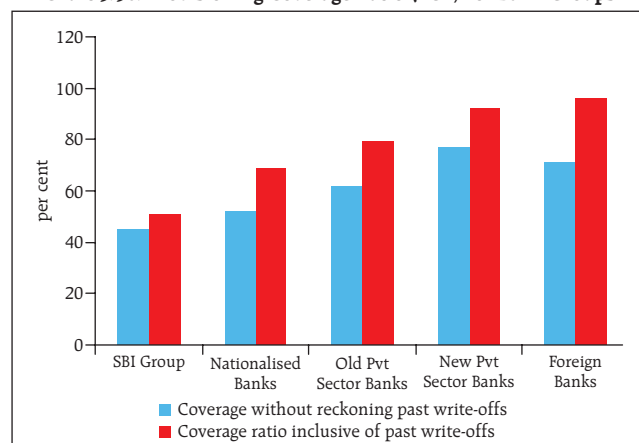
3.45 The SCBs' profitability showed robust improvement during 2010-11 compared to 2009-10 (Chart 3.37). Interest income increased by 18.6 per cent

**Chart 3.35: Category wise NPAs**



Source: RBI supervisory returns

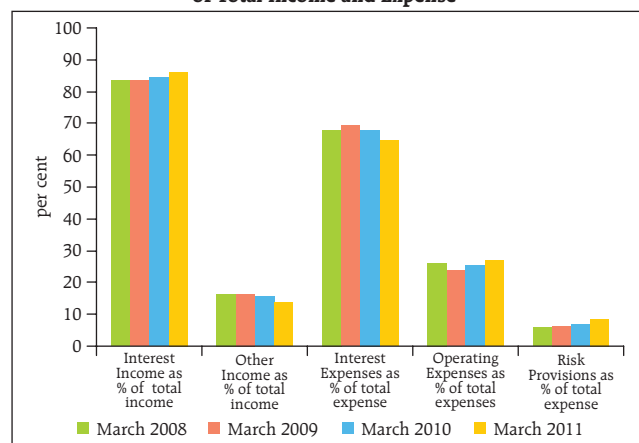
**Chart 3.36: Provisioning Coverage Ratio (PCR)<sup>#</sup> of Bank Groups**



# PCR = Provisions Held (Specific + Floating) plus stock of technical write-offs divided by Gross NPAs plus stock of technical write-offs\*100.

Source: RBI supervisory returns

**Chart 3.37: Income and Expense Components as Proportion of Total Income and Expense\***



\*Total expense includes provisions but not taxes.

Source: RBI Supervisory Returns

<sup>6</sup> Some of the banks that had been granted extension of time beyond the stipulated date *i.e.* September 30, 2010 for achieving the PCR of 70 percent on their request, have been advised to calculate the required provisions for 70 percent PCR as on September 30, 2010 and compute the shortfall there from. These banks have also been advised to build up the shortfall at the earliest.

<sup>7</sup> <http://www.rbi.org.in/scripts/NotificationUser.aspx?Id=6415&Mode=0>

over 7.5 per cent last year and interest expense increased by 10.1 per cent as against 4.0 per cent last year. Resultantly, there was improvement of 34.9 per cent in the Net Interest Income (NII) of the banks during 2010-11. The effect of increase in NII was seen in the 19.5 per cent growth in net profits despite little change in non-interest income, increase of 49 per cent in risk provisions and 24 per cent increase in operating expenses (Chart 3.38).

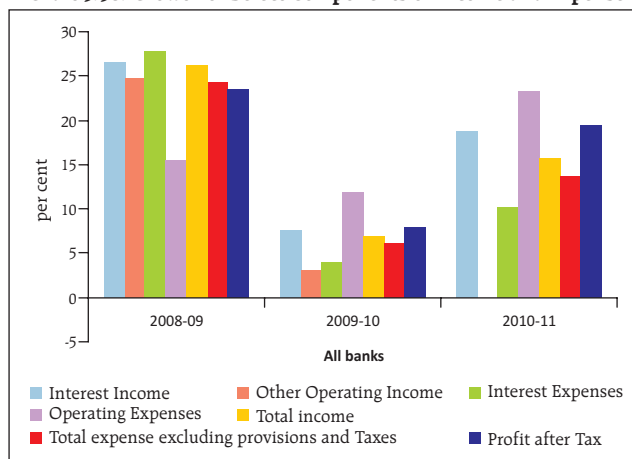
3.46 The growth in interest income by 18.6 per cent was, however, not in tandem with the growth in loans and advances which grew by 22.6 per cent during 2010-11. There did not also seem to be any decisive impact of the prescription of base rate as minimum lending rate on the interest income. Interest expense increased by only a little over 10 per cent despite increased quantum and cost of deposits, increased borrowings at higher interest rates and the requirement to compute interest on savings account balances on a daily basis.

3.47 The non-interest income of SCBs remained unchanged from the previous year due to increase in fee income and profits from forex operations getting nearly off-set by a 77 per cent decline in profits from trading in investment portfolio. The decline was possibly due to increasing interest rates and systemic liquidity strains in the second half of the year. The foreign banks continued to suffer major losses in their securities trading activities. There was also continuous decline in the share of the securities' trading profits in the banks' non-interest income after 2008-09 (Chart 3.39).

3.48 The non-interest expense of the banks showed a substantial rise of 24 per cent over the previous year mainly on account of staff expenses. Staff expenses increased by 30.6 per cent due to wage revisions effected by the PSBs. Share of staff expenses in non-interest expense stood at 58 per cent at system level (65 per cent in case of PSBs and 60 per cent in case of old private banks).

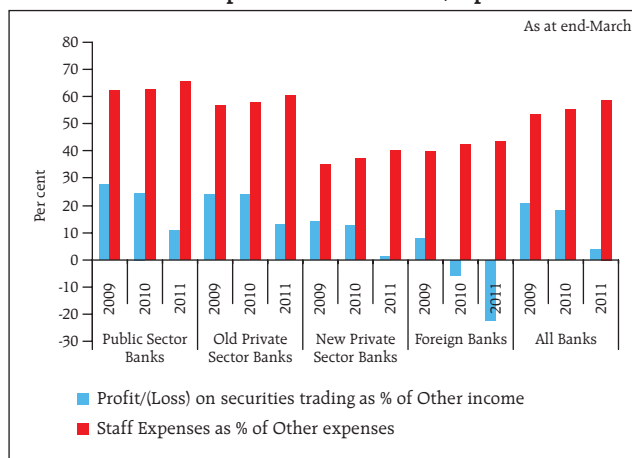
3.49 The wage revisions in case of PSBs and old private sector banks, amongst other things, included the impact of enhanced gratuity limits and opening of pension option for those who had not opted for it earlier. As stipulated by the Reserve Bank, banks were required to

Chart 3.38: Growth of Select Components of Income and Expense



Source: RBI Supervisory Returns

Chart 3.39: Share of Profit from Trading in Investments and Staff Expenses in Other Income/Expenses



Source: RBI supervisory returns



provide for the pension liabilities and enhanced gratuity limits of serving employees (amortisable in five years) and retired employees (without amortisation). While pension and gratuity related provisions formed a major portion of the staff expenses in 2011 particularly on account of bullet provisioning in case of retired employees, the impact of amortisation of pension liabilities for serving employees will be affecting the profitability in coming years as well. Going forward, it will be necessary for banks to build adequate provisions on consistent basis for such liabilities so that special regulatory dispensation is not sought (Box 3.2).

3.50 Aggregate risk provisions increased by 49 per cent during the year, the rise being mainly on account of the increased requirements for NPA provisions (regulatory stipulation of 70 per cent provisioning coverage ratio for NPAs as at end September 2010).

***Profitability ratios had improved at system level, however marginal deterioration was noticed in case of PSBs***

3.51 The profitability ratios of the SCBs indicated improvement over the previous year in as much as the return on assets (RoA) and the return on equity (RoE)

**Box.3.2: Provision for Pension and Gratuity Liabilities arising out of Wage Revision in Public Sector Banks and Old Private Sector Banks: Systemic Concerns**

Banks are required to provide prudently, on an ongoing basis for various types of Employee Benefits including Defined Benefit Plans such as Pension, Gratuity *etc.*, in accordance with the extant accounting standard AS 15 which is based on the International Accounting Standard IAS 19. This aspect becomes more critical subsequent to any wage revision.

The last wage revision of the PSBs and 10 old private sector banks which came under the 9th bipartite settlement under the aegis of Indian Banks' Association (IBA) was signed in April 2010. This wage revision introduced certain new elements, *viz.* (a) wage hike at a higher level of 17.5%; (b) offer of second option for pension to existing and retired employees; and (c) enhancement in gratuity limits from ₹ 3.5 lakh to ₹ 10 lakh, following the amendment to Payment of Gratuity Act, 1972. The expected additional liability of ₹ 30,366 crore, comprising second pension option (₹ 22,488 crore) and gratuity enhancement (₹ 7,878 crore) furnished by IBA, relating to 25 Public Sector Banks, was significant and constituted 81.9 per cent of their net profit for the year 2009-10. As per the accounting standards, these liabilities were required to be absorbed in the Profit & Loss Account. Since the banks could not absorb the impact of the additional burden on account of above, the IBA approached the Reserve Bank, on behalf of its member banks, seeking approval to amortise the additional liability. IBA contended that both these events were unanticipated and not recurring. In view of the above as well as the significant impact of these liabilities, it was decided to consider regulatory dispensation of amortisation to PSBs for a period of five years subject to certain conditions in consultation with the Institute of Chartered Accountants of India (ICAI). This dispensation was not available to liabilities in respect of retired/separated employees. The above dispensation was extended *mutatis mutandis*, to the ten old private sector banks who were signatories to the bipartite settlement.

In terms of the above dispensation, PSBs have absorbed an amount of ₹ 4971 crore towards pension and ₹ 1677 crore towards gratuity in the profit and loss account for the year ended March 31, 2011 while carrying the unamortized expenditure of ₹ 16,897 crore for pension and ₹ 2903 crore for gratuity in the balance sheet as on March 31, 2011.

SBI employees enjoy pension as a third benefit unlike other PSBs. Consequent to the revision of the wages in accordance with the 9th Bipartite Settlement the pension fund liability of the bank for FY 2011 was determined at ₹ 11,707 crore. SBI had requested that the additional costs of pension liability arising on account of revision of pension consequent upon the 9th bipartite settlement should be evenly spread over the future working lifetime of the employees which was not agreed to by the Reserve Bank since the increase in the liability was linked to the wage revision and could have been reasonably anticipated. However from a purely systemic stability point of view, the impact on SBI's profitability being very significant, regulatory dispensation allowing adjustment against reserves to meet the additional pension liability, net of current year's liability was allowed. In the event, the bank provided ₹ 2473 crore to the Profit and Loss Account and the balance of ₹ 7927 crore was charged to the reserves.

Going forward it is necessary that banks build adequate provisions for such liabilities in a phased manner in order that regulatory dispensation is not sought and the burden is not concentrated in the year that the settlement is signed. This also has systemic stability issues arising from under-provisioning and non compliance with Accounting Standards in vogue, especially since the Indian Accounting Standards are on the verge of convergence with the International Financial Reporting Standards (IFRS). The matter has been taken up with the IBA. Banks are also being advised to make a proper assessment of their superannuation liabilities and provide for the same from the year in which the periodical wage settlements fall due and not from the year in which such settlements are signed.

of the banks increased from 1.0 per cent and 13.3 per cent in 2009-10 to 1.1 per cent and 13.7 per cent in 2010-11 (Chart 3.40). However, in case of PSBs, these ratios deteriorated (from 1.0 per cent and 16.2 per cent to 0.9 and 15.4 per cent respectively). Interest spread improved from 2.7 to 3.1 per cent.

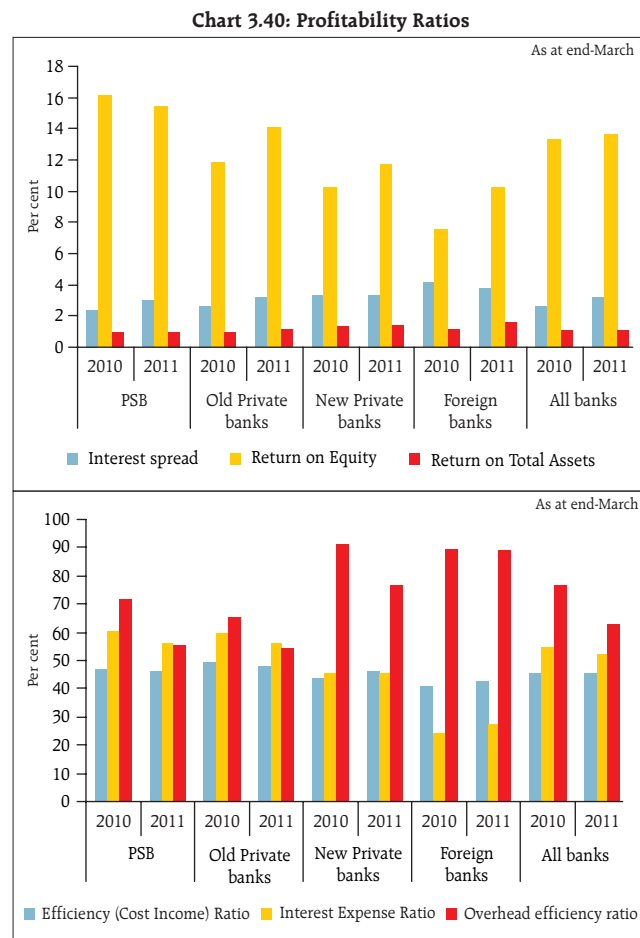
3.52 Going forward, increasing interest rates, hike in the savings account interest rate and potentially enhanced provisioning requirements for NPAs as well as provisions for pension liabilities may impact the profitability of banks.

### Banking Stability Map

#### *Liquidity indicators exhibited increased risk*

3.53 The Banking Stability Map and Indicator were introduced in the previous FSR to present an overall assessment of changes in underlying conditions and risk factors having bearing on stability of the banking sector. The assessment was based on five dimensions during a given period. The methodology has been further enhanced by including certain other indicators for each of the five dimensions<sup>8</sup> (Table 3.2).

3.54 The Banking Stability Map indicates that relatively, risks to soundness and liquidity increased in March 2011 as compared to March 2009 and March 2010, whereas risks due to efficiency, asset quality and



Source: RBI supervisory returns

**Table 3.2: Indicators used for Construction of Banking Stability Map and Banking Stability Indicator**

| Dimension            | Ratios                        |                                                 |                                                        |                                                     |
|----------------------|-------------------------------|-------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------|
| <b>Soundness</b>     | CRAR                          | Tier-I Capital to Tier-II Capital               | Leverage ratio as Total-Assets to Capital and Reserves |                                                     |
| <b>Asset-Quality</b> | Net NPAs to Total-Advances    | Gross NPAs to Total-Advances                    | Sub-Standard-advances to gross NPAs                    | Restructured-Standard-Advances to Standard-Advances |
| <b>Profitability</b> | Return on Assets              | Net Interest Margin                             | Growth in Profit                                       |                                                     |
| <b>Liquidity</b>     | Liquid-Assets to Total-Assets | Customer-Deposits to Total-Assets               | Non-Bank-Advances to Customer-Deposits                 | Deposits maturing within-1-year to Total Deposits   |
| <b>Efficiency</b>    | Cost to Income                | Business (Credit + Deposits) to total employees |                                                        |                                                     |

<sup>8</sup> The five composite indices represent the five dimensions of Soundness, Asset quality, Profitability, Liquidity and Efficiency. Each index, representing a dimension of bank functioning, takes a value between zero (minimum) and 1 (maximum). Each index is a relative measure during the sample period used for its construction, where a high value means the risk in that dimension is high. Therefore, an increase in the value of the index in any particular dimension indicates an increase in risk in that dimension for that period as compared to other periods. For each ratio a weighted average for the banking sector is derived, where the weights are the ratio of individual bank's asset to total banking system assets. Each index is normalised for the sample period as 'ratio-on-a-given-date minus minimum-value-in-sample-period divided by maximum-value-in-sample-period minus minimum-value-in-sample-period'. A composite measure of each dimension is calculated as a weighted average of normalised ratios used for that dimension, where the weights are based on the marks assigned for supervisory assessment of CAMELS rating of the banks.

profitability declined (Chart 3.41). The dimensional increase in liquidity risk of the banking sector was, at least partially, attributable to the decline in the level of liquid assets. Though the soundness indicators showed a relative deterioration *vis-à-vis* the position in previous year, the ratios continue to remain well above the regulatory requirements.

### Banking Stability Indicator

***Banking Stability Indicator has, barring few fluctuations, strengthened over the years***

3.55 Based on the individual composite indices for each dimension, the Banking Stability Indicator is constructed as a simple average of the five composite sub-indices mentioned in Table 3.2. A quarterly series of the Indicator shows an overall improved stability in the banking sector, barring a slight dip in September 2010 (Chart 3.42).

### Regional Rural Banks (RRBs)

***Performance of RRBs in Category II and III needs to be monitored***

3.56 RRBs have a large branch network in the rural area (11861), accounting for nearly 37 per cent of the total rural branch network of all commercial banks including RRBs. RRBs are categorised into three categories - Sustainable viable (Category I - 55 RRBs), Current viable (Category II - 24 RRBs) and Loss making (Category III - 3 RRBs) - based on select parameters like profit and profit earning capacity, *etc.* An analysis of the performance of the three loss making RRBs and 24 other RRBs in Category II revealed some concerns. In order to align the RRBs with the operational efficiency gained by other banks through IT enabled products, a Road Map for adoption of CBS in RRBs has been finalised and is targeted to be completed by September 2011.

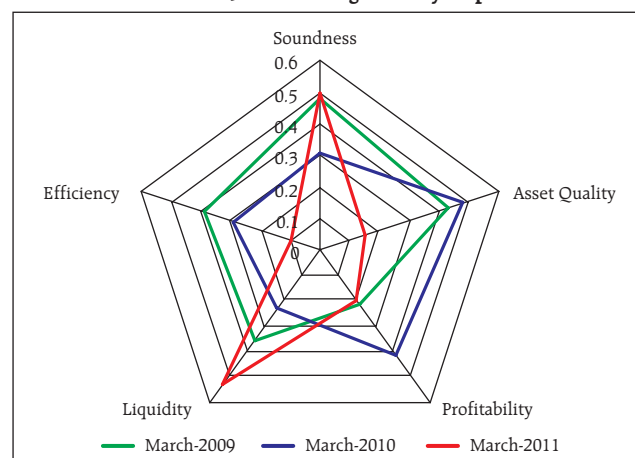
### Cooperative Banking Sector

#### Rural Co-operative Credit

***Financial soundness remained an area of concern***

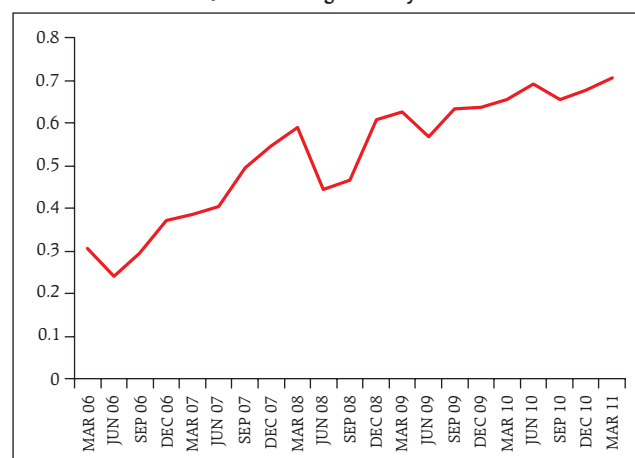
3.57 At the aggregate level, the gross NPA ratios as at end March 2010<sup>9</sup> improved for the short term

**Chart 3.41: Banking Stability Map**



Away from the center signifies more risk  
Source: Supervisory Data and RBI staff calculations

**Chart 3.42: Banking Stability Indicator**



Higher value signifies more stability  
Source: Supervisory Data and RBI staff calculations

<sup>9</sup> Latest data available. Data for 2010 is provisional. Data in case of certain States pertains to 2007-08 and 2008-09.

co-operative credit institutions (StCB & DCCB). For the long term institutions (SCARDB & PCARDB), the ratios deteriorated further (Chart 3.43). 52 per cent of StCBs and 40 per cent of DCCBs had achieved a CRAR of 9 per cent and above. Regulatory measures, such as, requiring a minimum CRAR of 4 per cent as a pre-requisite for licensing have been introduced. Though norms in respect of minimum capital adequacy ratios have not yet been prescribed for the rural co-operative credit institutions, its disclosure has however been put in place since March 2008.

3.58 During 2009-10, there was marginal improvement in the profitability of StCBs and DCCBs (8 per cent and 2 per cent respectively) though the profits came from banks in few regions. There was a significant increase in the number of loss making branches of long term co-operative credit institutions.

3.59 The number of StCBs that remained to be licensed remained unchanged at 7 since the publication of the previous FSR. Some improvement was, however, discernible in case of DCCBs as the number of unlicensed institutions came down from 164 to 150.

**Urban Co-operative Banks (UCBs)**

***Consolidation exercise continued amid improving financials***

3.60 Consolidation of UCBs continued with the issuance of 11 NOCs (in addition to 103 NOCs as at September 2010) for mergers and notification of 18 mergers (in addition to 71 notifications as at end September 2010). These consolidation measures have led to a reduction in the number of weak and unlicensed banks in the sector. Consequently, the financial soundness indicators of scheduled UCBs have improved (Chart 3.44).

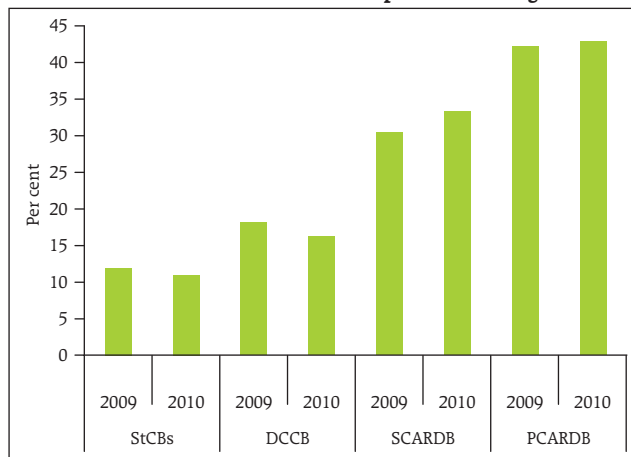
**Non-banking Financial Companies (NBFCs)**

***Increase in the business was concomitant with improvement in the financial soundness indicators***

**Non Deposit taking Systemically Important NBFCs (NBFC-ND-SIs)**

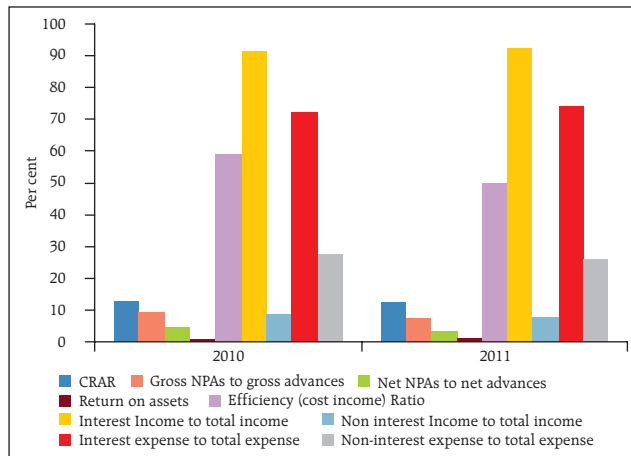
3.61 The balance sheet size of NBFC-ND-SIs increased by 21.1 per cent in 2010-11, mainly on account of borrowings which increased by 25.3 per cent.

**Chart 3.43: Gross NPA Ratio of Co-operative Banking Sector**



Source: RBI supervisory returns

**Chart 3.44: Select Financial Performance Indicators of Scheduled UCBs**



Source: RBI Supervisory Returns

Borrowings from banks/FIs formed a major proportion (30.3 per cent) of their total borrowings. On the asset side, loans and advances increased by 27.6 per cent. Asset quality and profitability improved over the previous year, though capital adequacy ratios showed marginal decline, nonetheless remaining well above the regulatory minimum stipulated (Charts 3.45 and 3.46).

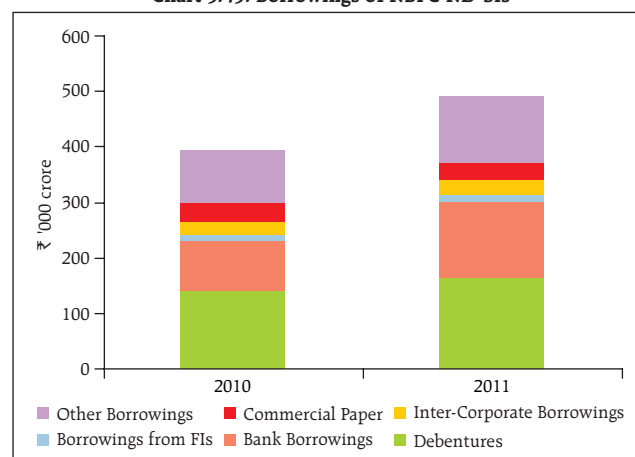
### NBFCs Deposit taking (NBFC-Ds)

3.62 In case of NBFC-Ds, loans and advances increased by three per cent as at end September 2010<sup>10</sup> over previous half year. Asset quality and capital adequacy ratios showed improvement (Chart 3.47).

### Regulatory architecture - revisions in light of systemic interconnectedness

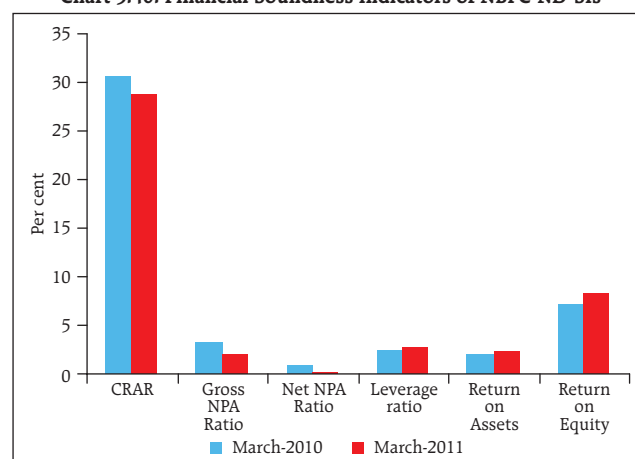
3.63 Keeping in view the economic role and heterogeneity of the NBFC sector and its systemic interconnectedness, the regulation of this sector has been progressively tightened. As a part of the important regulatory initiatives taken recently in this regard, the CRAR of both NBFC-ND-SIs and NBFC-Ds have been aligned to 15 per cent from the earlier stipulation of 12 per cent (stipulation in case of NBFC-Ds becoming effective as at end-March 2012). Provisioning of 0.25 per cent for standard assets and a prudential cap on banks' exposures to debt oriented mutual funds have also been stipulated. There were concerns arising due to concentration risk in NBFCs engaged primarily in making loans against gold jewellery, high interest rate charged by these companies, difficulties in ensuring end use of funds, collateral risks in such exposures., *etc.* As a measure to address these issues, the Reserve Bank directed that the bank loans to NBFCs for on-lending against gold jewellery, would be no more eligible for classification under agriculture sector. Further in a separate move, it was announced that bank loans to NBFCs, other than to such MFIs which fulfilled certain recently introduced eligibility conditions (as mentioned in next paragraph), would not be eligible to be classified as priority sector loans. As discussed in Chapter IV, a Working Group has been formed to address the entire gamut of issues relating to the regulation of NBFCs.

Chart 3.45: Borrowings of NBFC-ND-SIs



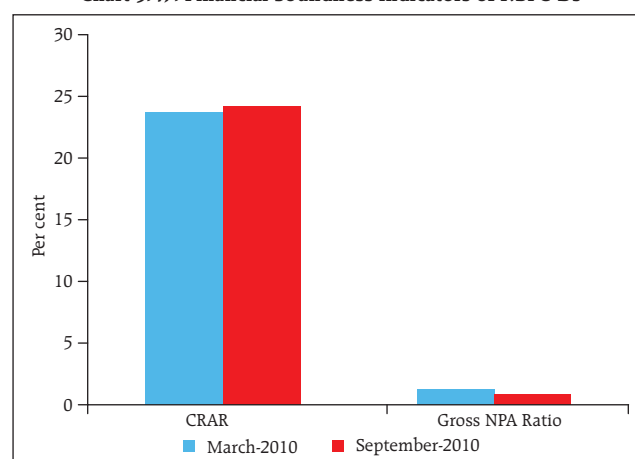
Source: RBI Supervisory Returns

Chart 3.46: Financial Soundness Indicators of NBFC-ND-SIs



Source: RBI Supervisory Returns

Chart 3.47: Financial Soundness Indicators of NBFC-Ds



Source: RBI Supervisory Returns

<sup>10</sup> Latest off-site data available

**Addressing issues in the MFI sector**

3.64 Pursuant to the Malegam Committee recommendations on microfinance sector, bank loans to all Micro-finance Institutions (MFIs), including NBFCs working as MFIs, will be eligible for classification as priority sector loans only if the prescribed percentage of their total assets are in the nature of 'qualifying assets' and they adhere to the 'pricing of interest' guidelines to be issued in this regard. Bank loans to other NBFCs would not be reckoned as priority sector loans with effect from April 1, 2011. Further, following the sharp drop in collections by MFIs in Andhra Pradesh and some incipient signs of contagion spreading to other States, a special regulatory asset classification benefit was extended to the restructured MFI accounts, which were standard at the time of restructuring, even if they were not fully secured.

**Insurance Sector - Critical Component of Financial Sector**

3.65 Insurance companies are a critical component of the financial sector and their smooth functioning is a necessary pre-condition to maintain financial stability, both domestically and globally. The sector faces several risks - risks related to solvency, investment returns,

economic downturns, issues related to persistency<sup>11</sup>, etc. - though they are generally considered to be contributing less to systemic risk than the banks (Box 3.3).

**Opening of the sector to private sector has led to higher growth and penetration of insurance in the country**

3.66 With the opening up of the insurance sector in India in the year 2000, the industry has been witness to the entry of 22 players in the life segment and 15 in the non-life segment in addition to three insurers with license to operate on a standalone basis in the health insurance sector. The foreign participation in the industry is permitted through joint venture with an Indian promoter with FDI cap fixed at 26 per cent. The total number of insurers registered with the Insurance Regulatory and Development Authority (IRDA), the insurance sector's regulator, as on March 31, 2011 stood at 48 *viz.*, 23 life insurers, 19 general insurers, 3 standalone health insurance companies and 2 specialised companies - one dealing with credit insurance and crop insurance and the other being a reinsurer. Partially, as a result of these measures, the insurance penetration (as measured by the ratio of premium underwritten in a given year to the Gross

**Box 3.3 Systemic Risks posed by the Insurance Sector**

Insurance sector does not contribute to systemic risk in the manner banking sector does. In contrast to banking activity, which is about maturity transformation, insurance sector collects its premia in advance rather than in arrears to fund its obligations. Such upfront funding reduces liquidity risks and reliance on leverage if the premia are priced correctly. Another differentiating feature of insurance sector is that policies are not like checking accounts, *i.e.* balances are not withdrawable on demand. Policy-holders are not allowed to withdraw money from their policy balances at will and such requests entail heavy penal charges. Therefore, the equivalent of a 'bank run' is uncommon in the insurance sector. Unlike banking, where a fall in value of assets significantly below that of liabilities causes failures immediately through bank runs, insolvency in insurance sector plays out in 'slow motion' over several years. This is due to the longer term claims and the much more dispersed payout dates on insurance products. Insurers typically have more

flexibility and time to deal with a crisis than do banks which have to meet deposit withdrawals in the short term.

However, in case of insurance companies being a part of financial conglomerate, their bankruptcy can trigger systemic risk by casting doubt on the creditworthiness of the conglomerate's commercial bank, particularly if the bank is of sufficiently large size. Nonetheless, prohibition of multiple use of capital within a financial conglomerate effectively reduces this source of systemic risk. Inter-linkages of insurance activities with other financial institutions also could be a source of disruption in the financial system (the banking sector in particular). For instance, insurers are typically the major investors in many financial markets - equities and government securities and considerably affect stock market movements. In case of non-life insurance business, where the premium ceded to foreign re-insurers is significant, the domestic exchange rate movements may be significant.

<sup>11</sup> Percentage of life insurance or other insurance policies remaining in force; percentage of policies that have not lapsed. The higher the percentage, the greater the persistency. Since it is an important measure of a company's retention of its life insurance business, most companies extend every effort to increase persistency.

Domestic Product (GDP) of the year) has increased from 2.3 in 2000 to 5.4 in 2009.

3.67 The linked<sup>12</sup> and non linked business of the Life Insurance Industry accounted for 42.1 and 57.9 per cent of the first year premium underwritten in 2010-11 as against 8.5 and 91.5 per cent respectively in the year 2003-04<sup>13</sup>.

3.68 In the Indian context, insurance companies are required to adhere to a range of prudential norms *viz.* minimum capital, solvency ratio, exposure norms, investment exposure patterns, *etc.* for life and general insurers. Also, the insurance companies are not permitted to take positions in commodity market, to avail loans from banks and to invest policy holders' funds abroad. As a first step towards 'Risk Based Capital' and hence 'Risk Based Supervision' system, life insurance companies are now required to submit 'Economic Capital' report to the IRDA as part of their annual actuarial and other reports. The 'Economic Capital' computation involves quantification of specific risks and assesses the insurer's capital requirements with reference to various risks faced by the insurer. This regulatory framework facilitates management of systemic risks of the insurance sector. Nevertheless, in order to ensure that core insurance activities do not cause a systemic shock or trigger a systemic event, inter-linkages of the sector with the rest of the financial system needs to be carefully monitored.

### Concluding Remarks

3.69 In India, increase in credit off take during 2010-11 was above its long term trend. Credit growth appeared to be concentrated in certain sectors, which called for vigilance on this front to contain build up of risks/excesses. Recovery in credit growth has led to the expansion of the balance sheets of SCBs by about 19 per cent. However, slack growth in deposits have also resulted in continued dependence on borrowing and other short term means to fund the expansion. The

rising structural mismatch in the maturity profile of the deposits and advances further contributed to the liquidity concerns.

3.70 Credit growth, despite being well diversified in many sectors, appeared to be weighed more by growth in retail, commercial real estate and infrastructure credit. A study of deployment of bank credit in thirty eight major industries showed a declining trend in exposure towards high risk industries. Off balance sheet exposures of banks continued to rise, with the foreign banks showing the largest increase with their notional exposure being more than 18 times their on-balance sheet exposures.

3.71 Capital adequacy of the SCBs continued to be strong, though there was a minor decline due to robust credit off take. Leverage ratio of banks in India remained comfortably above 3 per cent, as required under the Basel III norms.

3.72 Asset quality improved on the back of rebound in credit off take as credit growth outpaced the growth in NPAs. Going forward, the rapid credit growth also raised the possibility of large scale slippages, requiring continued vigilance. In this regard, the Reserve Bank's countercyclical measures stipulating minimum NPA provisioning coverage ratio of 70 per cent on the level of NPAs as on September 30, 2010 may act as a cushion against possible rise in the NPAs.

3.73 The SCBs' profitability showed improvement during 2010-11. However, on account of increase in provisioning towards pension liabilities, the staff expenses of PSBs increased sharply. Going forward, increasing interest rates, hike in the savings account interest rate amortisation of pension and gratuity liabilities and potentially enhanced provisioning requirements for NPAs may impact the profitability of banks.

3.74 The Banking Stability Map indicated that risks to liquidity had increased as at end March 2011 over March

<sup>12</sup> These products (Unit Linked Insurance Plans-ULIPs) provide insurance cover to the policyholder and higher returns over the long-term, due to diversified investments in equity and debt instruments. ULIPs are different from traditional products in that the risks and rewards underlying the investment component of the premium underwritten by the insurance company are borne entirely by the policyholder. The policyholder determines the investment pattern from out of the various options, as to the proportion of debt, equity and money market instruments indicated by the insurer, based on his risk aptitude.

<sup>13</sup> Source : IRDA

2010. The Banking Stability Indicator however showed strengthening of the banking sector on the stability front.

3.75 The financial soundness of the co-operative sector remained a matter of concern though consolidation measures continued to progress. The regulation of non banking finance companies has been progressively tightened in order to plug regulatory gaps and dissuade regulatory arbitrage.

3.76 The penetration of the insurance sector has increased after it was opened up to private players and FDI through joint ventures was permitted. The regulatory framework for insurance in India has ensured a robust and well regulated sector. While the essential structure of the insurance business entails relatively lower systemic risk, the interconnectedness of the sector with the banking and the rest of the financial system could be a source of disruption which may need careful monitoring.



## Chapter IV

### Financial Sector Policies and Infrastructure

*Sound regulatory policies, robust arrangements for regulation of the financial system and smoothly functioning financial market infrastructure are critical building blocks for financial stability. In 2013, the phase-in period for Basel III measures commences. Efforts are already underway to migrate to advanced approaches under Basel II. Regulators and banks across the world, and especially in emerging markets like India, will face immense challenges in the days ahead. A few individual banks may need to raise additional capital. All banks will have to gear themselves for the demanding data and analytical requirements for the revised liquidity framework and for the advanced approaches under Basel II. Even as the supervisory framework for financial conglomerates is being strengthened, the financial holding company model is being proposed as the preferred model for large financial entities in the country. Arrangements for cross border supervisory cooperation are being strengthened in a bid to reduce the probability of a crisis. Regulatory gaps, especially in the NBFC sector, leave scope for arbitrage even as financial sector laws are being revamped and banking sector legislations amended to fortify the regulatory structure. Gaps in the regulatory arrangements for the cooperative sector enabling cooperative societies to raise deposits, including from external sources, without being subject to prudential norms needs to be addressed. While the Sub-committee of the Financial Stability and Development Council (FSDC) is expected to evolve as the more active, hands-on body for financial stability in normal times, the FSDC would have a broad oversight and assume a central role in times of crisis. The network of bilateral exposures of Indian banks is highly intertwined increasing risks of a contagion from the failure of any bank(s). Caps on interbank exposures limit the domino effect, but the network of connectivities needs to be continuously monitored. Payment and settlement systems in the country are robust, but are characterised by a significant degree of interdependencies which leave them vulnerable to idiosyncratic shocks. Safety net arrangements need to address critical issues in respect of adequacy and management of funds, coverage, recovery performance and time taken for settlement.*

4.1 The financial crisis that began in 2007 has revealed the need for a new supervisory and regulatory approach designed to strengthen the system and contain the risk of future financial and economic disruptions. The approach needs to be of a macroprudential nature, since recent events have shown that even rational choices at the individual level can lead to negative systemic consequences. In fact, better regulation, an effective regulatory architecture, efficient financial market infrastructure and robust analysis of data and information to identify burgeoning risks are key critical ingredients for ensuring financial stability.

4.2 The first part of the Chapter presents the current challenges as the Indian banking system attempts to migrate to the advanced approaches under Basel II and readies itself for the requirements of Basel III. It also highlights the regulatory efforts underway to strengthen

and improve financial sector policies. The second part of the Chapter presents the emerging issues in the arrangements for the regulation of the financial sector in the country, highlights gaps in the regulatory perimeter and flags avenues for regulatory arbitrage. The third part presents the results of an extensive modeling exercise undertaken to analyse the network of interbank exposures in the Indian banking system. Risks and vulnerabilities in the payment and settlement systems and the safety net arrangements are presented in the last part of the Chapter.

#### FINANCIAL SECTOR POLICIES

4.3 Significant progress has been made in crystallising the global regulatory reforms agenda which was set in motion with a view to strengthen the resilience of the banking sector and to removing the fault lines which

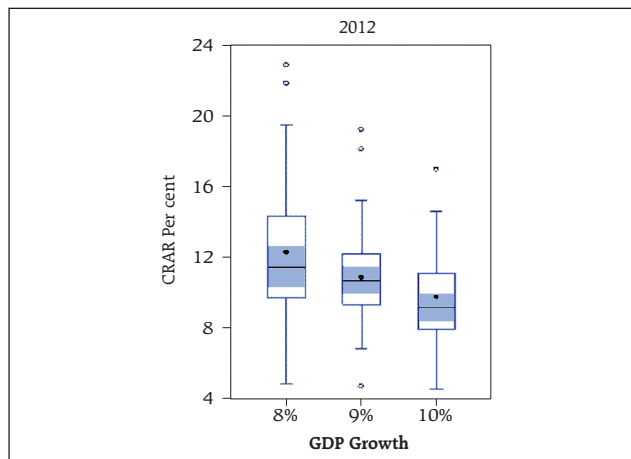
permitted the cyclical build up of risks. These were outlined in the previous FSR. The Reserve Bank remains committed to adoption of internationally agreed standards and reforms and efforts are ongoing to this end. Domestic initiatives to strengthen the regulatory framework of the financial sector continued in parallel with several measures - increasing specific provision requirements for non-performing assets, imposition of a prudential cap on banks' investments in debt oriented mutual funds, amongst others, being announced. Going forward, several challenges remain *viz.*, migration to advanced approaches under Basel II, adoption of Basel III proposals for capital, liquidity and leverage, calibration of the countercyclical buffer, convergence with the revised accounting standards, *etc.*, which are likely to test both the regulators and the regulated entities in the days to come.

**Higher capital requirements under Basel III**

4.4 Collectively, the new global standards to address both firm-specific and broader, systemic risks have been referred to as "Basel III", the building blocks of which were highlighted in the previous FSR. It had postulated that, given the comfortable capital adequacy position of banks in India, the Indian banking system is unlikely to be unduly stretched in meeting the more stringent requirements of the Basel III proposals. It was also highlighted that for emerging economies like India, the implementation comes at a time when credit demand is expected to pick up given, *inter alia*, the compulsions of robust growth, the investment needs of infrastructure and the demand ushered in by increasing financial inclusion. Thus, notwithstanding the current position at the aggregate level, a few individual banks may need to augment their capital.

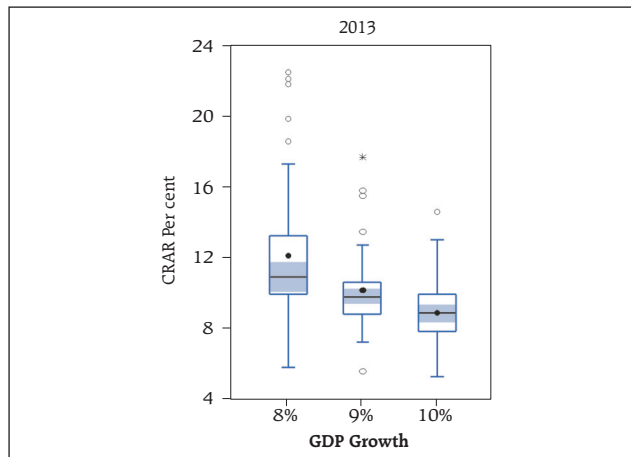
4.5 An internal study shows that this is, indeed, the case. A series of regression analyses were conducted to project risk weighted assets and capital adequacy of banks under different growth scenarios and assuming a conservative growth rate of capital funds through internal accruals at 15 per cent per annum. The analysis revealed that the capital adequacy ratios of several banks fall below the minimum regulatory requirements, even under a Basel II scenario, indicating that capital will need to be augmented in the coming years (Charts 4.1 and 4.2)<sup>1</sup>. This could prove to be a challenge for the banking

**Chart 4.1: CRAR Projections (2012)**



Source: Supervisory returns and RBI staff calculations.

**Chart 4.2: CRAR Projections (2013)**



Source: Supervisory returns and RBI staff calculations.

<sup>1</sup> The additional capital arrived at in the internal study represents the capital which banks will need to raise in order to maintain their capital adequacy ratios in a situation of robust credit growth which can be expected given the growth rates assumed in the study.

system, given the sluggish performance of the equity markets and could also put pressure on Government finances. The capital needs of banks will also be impacted due to the unamortised portion of pension liabilities to be absorbed by April 01, 2013 on migration to International Financial Reporting Standards (IFRS).

### ***Calibration of a countercyclical buffer presents challenges***

4.6 The Basel III proposals contemplate two capital buffers for the banking system – a capital conservation and a countercyclical buffer (Box 4.1). The calibration of the countercyclical buffers proposed under Basel III poses a number of challenges. The primary aim of the buffer is to achieve the broader macroprudential goal of protecting the banking sector from periods of excess aggregate credit growth which are often associated with the build-up of systemic risks. The regulatory authorities in each jurisdiction will, therefore, be required to monitor credit growth and make assessments of whether

such growth is excessive and/or is leading to the build-up of systemic risks. Based on this assessment, they will need to use their judgment to determine whether a countercyclical buffer requirement should be imposed, to what extent it should be imposed and when the requirement should be removed.

### ***Credit-to-GDP gap may not be a reliable indicator for calibrating the buffer***

4.7 The common reference guide suggested by the Basel Committee is based on the aggregate private sector credit-to-GDP gap. This indicator does not work well in all jurisdictions at all times. This is especially so in emerging economies like India, where it tends to rise for structural reasons – higher credit off take due to higher growth and greater financial inclusion. Also, some economic sectors are relatively new in India and banks have only recently begun financing them in a big way. The risk build-up, if any, in such sectors cannot accurately be captured by this ratio.

#### **Box 4.1: Capital Buffers Proposals Under Basel III**

*Capital Conservation Buffer:* The purpose of the conservation buffer is to ensure that banks maintain a buffer of capital that can be used to absorb losses during periods of financial and economic stress. While banks are allowed to draw on the buffer during such periods of stress, the closer their regulatory capital ratios approach the minimum requirement, the greater the constraints on earnings distributions. This framework will reinforce the objective of sound supervision and bank governance and address the collective action problem that has prevented some banks from curtailing distributions such as discretionary bonuses and high dividends, even in the face of deteriorating capital positions. The capital conservation buffer aims to establish a fixed range above the Common Equity Tier 1 minimum capital requirement of 4.5 per cent of Risk Weighted Assets (RWA). This buffer above the regulatory minimum requirement will be calibrated to a maximum of 2.5 per cent and has to be met with common equity, after the application of deductions. Hence, the total common equity requirements reach a level of 7 per cent. The capital conservation buffer will be phased in between 1 January 2016 and year end of 2018, becoming fully effective on 1 January 2019. It will begin at 0.625 per cent of RWAs in January 2016 and increase each subsequent year by an additional 0.625 percentage points, to reach its final level of 2.5 per cent of RWAs on 1 January 2019. However, individual countries have the discretion to impose shorter transition periods.

*Countercyclical Buffer:* The countercyclical capital buffer works on the principle of extending the size of capital conservation buffer during periods of excess credit growth. The purpose of the countercyclical buffer is to achieve the broader macroprudential goal of protecting the banking sector from a system wide build up of risk due to excess aggregate credit growth and to ensure that the banking sector in aggregate has the capital on hand to help maintain the flow of credit in the economy without its solvency being questioned, when the broader financial system experiences stress after a period of excess credit growth. Countercyclical buffers will be calibrated in the range of 0 to 2.5 per cent of RWAs. Deviations from the trend of the ratio of private credit to GDP is the indicator preferred by the Basel Committee for gauging excessive credit growth, but countries will also need to consider other variables like asset prices, funding spreads and CDS spreads, credit condition surveys, real GDP growth, etc. while also exercising a considerable degree of judgment in deciding on the application or release of the countercyclical buffer. A lead time of up to 12 months will be given to banks when the buffer is imposed. The release of the buffer can be allowed gradually in situations where credit growth slows and system-wide risks recede in a benign fashion.

*References :* *Basel III: A global regulatory framework for more resilient banks and banking systems, Dec 2010*  
*: BCBS Guidance note for national authorities operating the countercyclical capital buffer, Dec 2010*

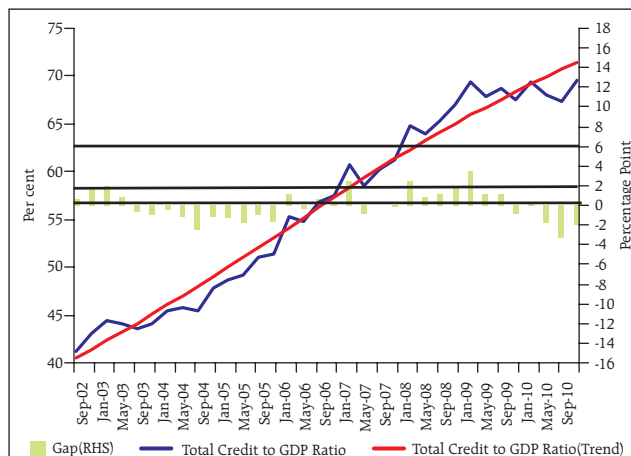
4.8 An assessment of the indicator in the Indian context (using both annualised and non-annualised GDP data) shows that reliable and timely signals in respect of imposing and removing the buffers are not thrown up in a consistent manner (Charts 4.3 and 4.4). In the first case, the deviations from trend are not significant enough to guide such decisions while in the second case, the gap is volatile making it difficult to draw conclusions.

**A mix of quantitative and qualitative indicators will have to guide the calibration of the buffer**

4.9 An examination, in the Indian context, of some of the other possible indicators suggested by the Basel Committee reveal that none of these indicators can be, on a standalone basis, considered reliable indicators for the calibration of the countercyclical buffer (Charts 4.5 to 4.8). The calibration of the buffer in the Indian context will, therefore, have to rely on a mix of qualitative and quantitative indicators and will require a considerable degree of judgment. Further, in India, sectoral approaches to countercyclical policies have stood the test in the past. The tools used in India to contain procyclicality are essentially time-varying provisioning for standard assets and differentiated risk weights for sensitive sectors.

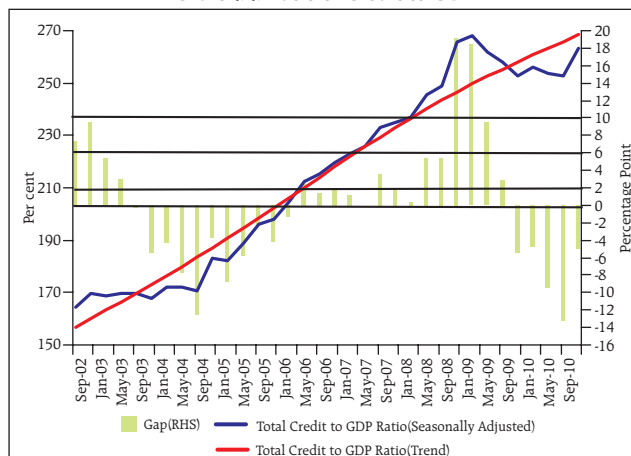
4.10 An internal Working Group in the Reserve Bank is currently examining the modalities of a framework to operationalise the countercyclical capital regime.

Chart 4.3: Ratio of Credit to GDP<sup>2</sup>



Source: CSO, Supervisory returns and RBI staff calculations.

Chart 4.4: Ratio of Credit to GDP<sup>3</sup>



Source: CSO, Supervisory returns and RBI staff calculations.

Chart 4.5: Real GDP Growth

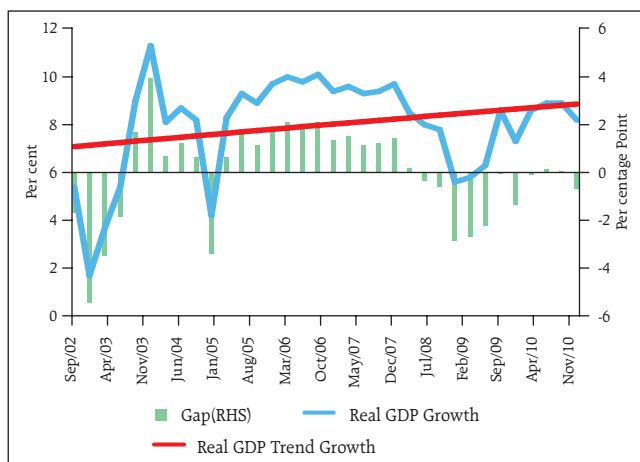
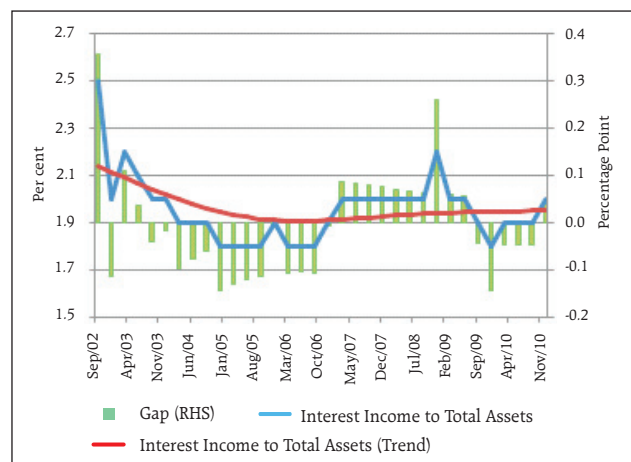


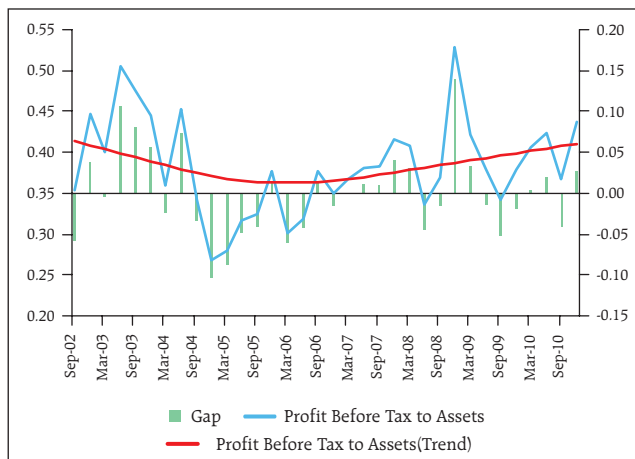
Chart 4.6: Interest Income to Total Assets



<sup>2</sup> Credit includes bank credit, external commercial borrowings, corporate bonds, NBFCs-D and UCBs. GDP is taken at current market price, which is annualised based on four quarters moving sum. The trend component of credit and GDP has been extracted using the Hodrick-Prescott filter.

<sup>3</sup> Credit includes bank credit, external commercial borrowings, corporate bonds, NBFCs-D and UCBs. GDP is taken at current market price. The trend component of credit and GDP has been extracted using the Hodrick-Prescott filter.

Chart 4.7: Profit Before Tax to Assets



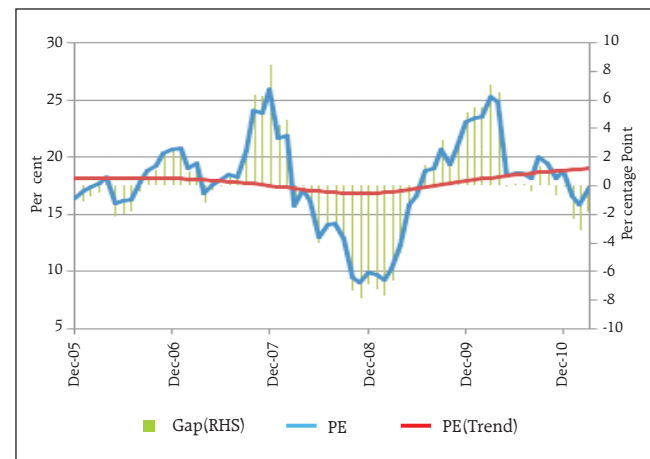
Source: CSO, Bloomberg, Supervisory returns and RBI staff calculations.

### ***Migrating to higher approaches under Basel II presents many challenges***

4.11 The time schedule for implementation of advanced approaches under Basel II was notified by the Reserve Bank. The guidelines for the implementation of the Internal Models Approach for market risk were released in April 2010. Guidelines on the Standardised Approach /Alternate Standardised Approach for operational risk were issued in March 2010 while those for Advanced Measurement Approach for operational risk were issued in April 2011. The guidelines on Internal Ratings Based Approach for credit risk are being formulated. Migration of banks to advanced approaches would be contingent on an internal assessment of their preparedness for the purpose and the prior approval of the Reserve Bank. Banks in India have the option of adopting the advanced approaches for one or more of the risk categories and it would not be necessary to adopt the advanced approaches for all the risk categories simultaneously.

4.12 Migration to advanced approaches under Basel II norms will facilitate a closer alignment of capital requirement with the risk profile of banks, improved quantification of Pillar II risks and enhanced monitoring and reporting processes. The process of migration, however, comes with inherent challenges. The foremost

Chart 4.8: Price to Earnings (PE) ratio



constraint is the availability of skilled personnel and robust data, especially in case of credit and operational risks. Internal rating systems to support the quantification of default and loss estimates, calibration of the exposure at default (EAD) and loss estimates to downturns and validation of risk models are integral to the advanced approach for credit risk. These systems require a large time series data, understanding of credit cycles and quantitative modeling of macro and micro level risk factors. On the other hand, operational risk modeling is a relatively new discipline and the methodologies are still evolving.

### ***Credit risk capital under the standardised approaches: Reliance on credit rating agencies will continue***

4.13 The previous FSR pointed out that the reliance of banks on external ratings for arriving at their capital requirements using the Standardised Approach under Basel II is likely to continue in many jurisdictions, including India, for some time. An empirical study to assess the adequacy of credit risk capital for the rated portfolio of banks was undertaken<sup>4</sup>. Risk weights were assigned based on a rating transition matrix including stressed transitions (stress scenarios envisaged a 50 per cent (Scenario 1) and 100 per cent (Scenario II) increase in downgradations). The analysis revealed that the risk weighted assets increased by up to nearly 15 per cent

<sup>4</sup> The study is based on the rating wise distribution of the portfolio of scheduled commercial banks as reported to the Reserve Bank. The study considers risk weights based on the rating distribution of the portfolio which would result if ratings migrated based on the average one year transition matrix (Transition matrix of CRISIL Ltd. has been used). For example, if 3 per cent of the AAA rated corporates are expected to migrate to AA rating, 3 per cent of the bank's AAA rated portfolio has been risk weighted at 30 per cent (as applicable to AA rated accounts) instead of 20 per cent (as applicable to AAA rated accounts).

when calculated based on forward looking ratings (including stressed ratings) (Chart 4.9).

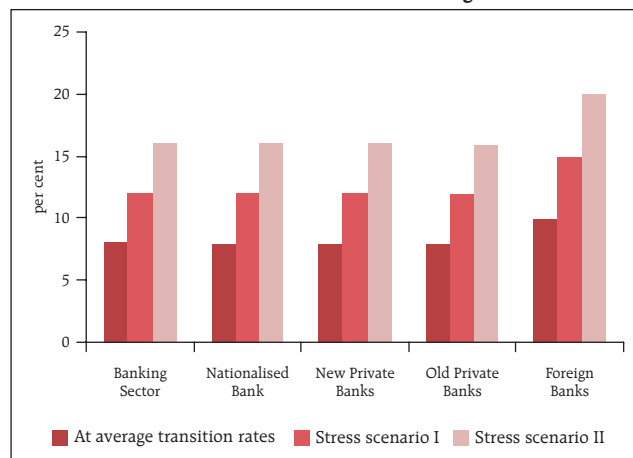
***Supervisory framework for Financial Conglomerates (FCs) being strengthened – issues relating to resolution and interconnectedness remain germane***

4.14 The previous FSR outlined the initiatives being undertaken internationally to reform policies for Systemically Important Financial Institutions (SIFIs) with a view to reducing the probability and impact of failure, improving resolution capacity and strengthening core financial infrastructures and markets. It also outlined the existing arrangements for the supervision of large FCs in India while highlighting the areas where improvements in the regulation and supervision of these large financial firms may be warranted. Issues related to the difficulties in orderly resolution of FCs and interconnectedness with the NBFC sector remain germane. While differential prudential norms may be required for FCs going forward, efforts to improve the arrangements for the supervision of these entities are already underway. The supervisory processes for the major banking groups are being strengthened: a revised offsite reporting format has been introduced to improve capturing of the group risk profile; the criteria for the identification of FCs has been revised to include off balance sheet position of banks and NBFCs; and guidelines on the corporate governance framework and management / monitoring of risks arising of intra-group transactions and exposures are being issued.

***The financial holding company model - the preferred model in India***

4.15 The previous FSR suggested that a holding company structure for FCs may better ring fence risks in the banking sector than the bank subsidiary model currently prevalent in the country. A Working Group on the Introduction of Financial Holding Company Structure in India<sup>5</sup> constituted by the Reserve Bank has since recommended that the financial holding company model should be pursued as the preferred model for the financial sector in India. It has recommended that a separate legislation should be enacted for the regulation of financial holding companies and that the Reserve

**Chart 4.9: Increase in Risk Weighted Assets Based on Transitional and Stressed Ratings**



Source: Supervisory returns and RBI staff calculations.

<sup>5</sup> [http://www.rbi.org.in/scripts/BS\\_PressReleaseDisplay.aspx?prid=24444](http://www.rbi.org.in/scripts/BS_PressReleaseDisplay.aspx?prid=24444)

Bank should be designated as the regulator for such companies (Box 4.2).

***MoUs with overseas supervisors to enhance cross-border supervisory cooperation***

4.16 International initiatives underlining the importance of cross border supervisory co-operation and information sharing gain importance in view of increasing cross border operations of Indian banks and growing presence of foreign banks in India. Till recently, there was a system of informal exchange of information and supervisory cooperation with various overseas regulators / supervisors on a bilateral "need to know" basis. However, as the need to enhance and structure this system was being increasingly felt, the Reserve Bank, in consultation with the Government, decided to enter into MoUs with overseas regulators for exchange of supervisory information within the available legal framework. The first such MoU has been signed between the Reserve Bank and the China Banking Regulatory

Commission (CBRC) in December 2010 and a few other MoUs are in the pipeline.

**REGULATORY ARCHITECTURE**

***FSDC and its Sub-Committee – coordinated oversight for financial stability***

4.17 The earlier FSRs have argued the case for central banks having a substantive role for financial stability while proposing that it cannot be an exclusive responsibility. In the Indian context, even as the Reserve Bank has implicitly been the systemic regulator in India, other financial sector regulators too have important responsibilities. Beyond the regulators, the global crisis has demonstrated the importance of the coordinating role the Government has to play, especially in times of stress. The post crisis focus on establishing an institutional mechanism for coordination among regulators and the Government has culminated in the establishment, in December 2010, of the Financial Stability and Development Council (FSDC) to be chaired

**Box 4.2: The Bank Subsidiary Model and the Financial Holding Company Model**

Over the years, banks have set up subsidiaries in various non-banking financial areas such as Mutual Funds, Housing Finance, Insurance, NBFCs, etc. This, in turn, led to the development of some large and complex financial institutions in the country, which are commonly referred to as Financial Conglomerates (FC). The emergence of FCs in India brought to the fore questions about the organisational structure of such entities, *i.e.* which should be the preferred corporate model for these entities. The issue acquired relevance from two distinct, though inter-related, perspectives – one, efficient corporate management within the groups addressing the growth and capital requirements of different entities; and two, the degree of regulatory comfort with different models, particularly in regard to the concerns relating to contagion risks. FCs in India, at present, are generally organised under the Bank Subsidiary Model (BSM) in which the bank is the parent of all the subsidiaries in the group. In contrast to this, a Holding Company Model (HCM), is one where commercial banking, insurance, investment banking, mutual fund, stock broking and other financial activities are conducted under the same corporate umbrella. The Working Group on the Introduction of Financial Holding Company Structure in India was mandated to examine the need and feasibility of introducing a financial holding company model in the Indian context, including by drawing lessons from the global financial crisis. The Working Group found that though the HCM is not conclusively superior to the BSM, it offers some distinct advantages, *viz.*,

a. A HCM is better in removing capital constraints and facilitating expansion in other financial services. Since

under the HCM, the subsidiaries will not be directly held by the bank, the responsibility to infuse capital in the subsidiaries would rest with the holding company;

- b. The model would also fare better in terms of direct impact of the losses of the subsidiaries, which would be borne by the holding company unlike in the case of BSM where it would be escalated to the consolidated balance sheet of the bank;
- c. Unlike in the case of BSM, under the HCM, the bank's board will not be burdened with the responsibility of managing the group's subsidiaries. Management of individual entities in a disaggregated structure is also expected to be easier and more effective;
- d. The HCM may enable a better regulatory oversight of financial groups from a systemic perspective. It would also be in consonance with the emerging post-crisis consensus of having an identified systemic regulator responsible *inter alia* for oversight of systemically important financial institutions (SIFI);
- e. The HCM would provide the requisite differentiation in regulatory approach for the holding company *vis-à-vis* the individual entities; and
- f. The HCM model is likely to allow for neater resolution of different entities as compared with BSM where liquidation of the parent bank may make the liquidation of subsidiaries inevitable.

by the Union Finance Minister. The FSDC is to be assisted by a Sub-Committee to be chaired by the Governor of the Reserve Bank. This structure attempts to strike a balance between the sovereign's objective of ensuring financial stability to reduce the probability of a crisis and the operative arrangements involving the central bank and the other regulators. While the Sub-Committee is expected to evolve as a more active, hands-on body for financial stability in normal times, the FSDC would have a broad oversight and will assume a central role in crisis times.

### Legislative reforms

#### ***FSLRC constituted – revision to legislations in tune with the current policy framework***

4.18 The Union Budget 2010 proposed the setting up of a separate Financial Sector Legislative Reforms Commission (FSLRC) to rewrite and clean up the financial sector laws. The FSLRC has since been formed under the chairmanship of Justice (Retd.) B. N. Srikrishna and has constituted eight sub-committees that will look into areas such as banking, pension, insurance, capital markets, debt management office, forward markets and legal processes. As the previous FSR argued, there is a strong case for reviewing the various legislations and recasting them in tune with the current policy frameworks.

#### ***Proposed amendments to the legislative framework for banks to make regulatory powers of the Reserve Bank more effective***

4.19 The Banking Laws (Amendment) Act, 2011 has been introduced in the Parliament in March 2011 seeking to amend the Banking Regulation Act, 1949, the Banking Companies (Acquisition and Transfer of Undertakings) Act, 1970 and the Banking Companies (Acquisition and Transfer of Undertakings) Act, 1980 to, *inter alia*, make the regulatory powers of the Reserve Bank more effective and to increase the access of the nationalised banks to capital market (Box 4.3).

### Non Banking Financial Sector

#### ***The non-banking financial sector in India – within a regulatory ambit***

4.20 Strengthening regulation and supervision of shadow banking has been identified by the G20 Leaders

as a critical issue for financial sector regulation. In the Indian context, as reported in previous FSRs, the NBFC sector is not typically a shadow banking sector as in the case of advanced economies since the sector is largely regulated by the Reserve Bank, SEBI, IRDA and NHB. Money market instruments like commercial paper and short term non-convertible debentures (NCDs) are regulated by the Reserve Bank while SEBI regulates mutual funds and longer tenure NCDs.

#### ***Gaps in regulation remain even as the entities continue to be closely interconnected***

4.21 The previous FSR highlighted the fact that while NBFCs are subjected to prudential regulations, the regulations vis-à-vis banks is asymmetrical, with banks being subjected to more stringent regulations. It was also highlighted that the presence of multiple regulators for the NBFCs in the country and an entity based approach to regulation give rise to possible regulatory gaps. Many entities, which are borrowing both from the markets and the banks, have the capability of being over-leveraged and, being deeply interconnected, can pose systemic risks. Both banks and mutual funds also invest in corporate paper of NBFCs thereby enhancing the financial integration of these entities. Some restrictions exist on the NBFC exposures that banks can take and the Reserve Bank has recently announced a prudential cap on banks' exposures to debt oriented mutual funds<sup>6</sup>. Several measures to tighten the regulatory framework for NBFCs have also been announced, as discussed in Chapter III of this Report. Nevertheless, these entities remain closely interconnected.

4.22 There are also differences in regulatory requirements of different NBFCs carrying on similar activities and gaps in regulation of certain entities give rise to potential for regulatory arbitrage. The previous FSR highlighted some such instances. Further, there are important differences in the regulatory requirements applicable to brokers for margin trading and those applicable to NBFCs undertaking similar activities especially with respect to requirements of minimum net owned funds, restrictions on borrowings, availability of margin trading facility for initial public offerings and other risk management prescriptions. There is also a need to bring in Alternative Investment funds including

<sup>6</sup> The Monetary Policy Statement for 2011-12 announced that investment of banks in liquid schemes of debt oriented mutual funds will be subject to a prudential cap of 10 per cent of their net worth as on March 31 of the previous year (<http://www.rbi.org.in/scripts/NotificationUser.aspx?Mode=0&Id=6376>).



### Box 4.3: Main Features of the Proposed Amendments to Banking Legislations

- (A) The main features of the proposed amendments to the Banking Regulation Act, 1949:
- (i) To exempt mergers and acquisitions of the banking companies from the applicability of the provisions of the Competition Act, 2002;
  - (ii) To confer power upon the Reserve Bank to specify approved securities;
  - (iii) To enable banking companies to issue preference shares subject to regulatory guidelines issued by Reserve Bank;
  - (iv) To remove the existing restrictions on voting rights limited to ten per cent of the total voting rights of all the shareholders of the banking company;
  - (v) To provide for prior approval of Reserve Bank for acquisition of 5 per cent or more shares or voting rights in a banking company;
  - (vi) To align the restriction on commission, *etc.*, on sale of shares to issue price rather than to the paid-up value of shares;
  - (vii) To confer power upon the Reserve Bank to specify the cash reserve ratio for select banks;
  - (viii) To establish a "Depositor Education and Awareness Fund" to take over inoperative deposit accounts (accounts not claimed /operated for a period of ten years or more);
  - (ix) To confer power upon the Reserve Bank to call for information and returns from the associate enterprises of banking companies and to inspect the same, if necessary;
- (B) The main features of amendments proposed in the Banking Companies (Acquisition and Transfer of Undertakings) Act, 1970 and 1980:
- (i) Enable the nationalised banks to increase or decrease the authorised capital with the approval from the Central Government and the Reserve Bank without being limited by the ceiling of a maximum of three thousand crore of rupees;
  - (ii) Permit the nationalised banks to issue two additional instruments ("bonus shares" and "rights issue") for assessing the capital market to raise capital required for expansion of banking business;
  - (iii) Raise restriction on voting rights from the existing 1% to 10 % for shareholders other than the Central Government.

private pools of capital such as hedge funds, private equity funds, *etc.* within the regulatory perimeter. Further, NBFCs set up by banks to carry on activities that can be undertaken by banks presents a clear case of regulatory arbitrage both on the assets and liabilities side.

4.23 A Working Group on NBFCs is, *inter alia*, examining issues related to regulatory gaps and identifying arbitrage opportunities that exist in the system, enhancing disclosure requirements, improved supervisory practices, *etc.*

#### ***Systemic importance of Government sponsored NBFCs warrants their being subject to prudential regulation***

4.24 There are at present 37 Government owned NBFCs (five NBFCs owned by the Central Government and 32 by various State Governments). Nine of these entities

are deposit taking NBFCs, with deposits amounting to nearly ₹ 2,000 crore as on March 31, 2010, while the total advances of the 37 companies stood at nearly ₹ 2.9 lakh crore. Further, the assets of these companies have been progressively increasing over the years with funding largely through public markets.

4.25 These entities have so far been exempted from the prudential regulatory framework for NBFCs as they are under the administrative control of a ministry of the Government and because they were deemed to pose less supervisory concern with regard to protection of depositors' interest. Over time, the systemic importance of the Government entities has increased with the expanding size of their balance sheets and their growing interaction with the financial system. At the same time, the regulatory framework for NBFCs has also acquired

an explicit focus on the systemic risks posed by the sector and on regulatory arbitrage. It has, therefore, been decided to revisit the exemptions granted to these NBFCs in consultation with the Government.

***The regulatory framework for wealth management services warrants examination***

4.26 A recent high profile fraud unearthed in the wealth management services offered by a bank in the country has thrown open a host of issues regarding the regulation of such activities and the conflicts of interest in the Indian financial sector. In the Indian context, activities related to portfolio management services (PMS) are governed by the SEBI (Portfolio Managers) Regulations and Rules, 1993. Amongst banks, one major public sector bank has been permitted to offer PMS for a few pension/superannuation funds. Other banks are only permitted to undertake non-discretionary investment advisory service with the prior approval of the Reserve Bank. Over time, however, the distinction between offering advisory and portfolio management services has become increasingly blurred, as is evident from the aforesaid fraud.

4.27 There is, therefore, a need to revisit the entire set of regulatory prescriptions for wealth management services including formulation of regulations for investment advisers and for harmonising instructions issued by different regulators. To this end, the Reserve Bank is in the process of conducting a survey in respect of wealth management activities being provided by banks. SEBI is also considering putting in place an appropriate regulatory framework for such activities. Above all, the issue of banks selling third party products and the conflicts of interest entails greater examination.

***Proliferation of structured products in an unregulated space may pose systemic concerns***

4.28 Structured products, in the Indian context, are being issued mainly by NBFCs in the form of debt securities with returns linked to equity, commodities *etc.* These products, which are issued as debentures and are typically privately placed, are currently not subject to any specific regulatory regime. They are sold

mainly to High Net worth Investors through portfolio managers or through wealth management services of banks. They are complex securities where the investors may not be able to understand the underlying risks. There is also a risk involved in the ability of the issuer to create a proper hedge. As these are illiquid instruments, there are concerns relating to valuation of such instruments. While the quantum of outstanding structured products is not very significant at the current juncture, the complexity and lack of transparency of such products, their illiquidity and concerns over valuation, and their potential ability to influence asset prices through the derivatives markets may give rise to systemic concerns, especially if such products proliferate in an unregulated space.

***Regulatory gaps permitting deposit raising activities of cooperative societies without being subject to prudential norms need to be plugged***

4.29 Banking activities of primary (urban) co-operative banks originally registered as co-operative credit societies are regulated by the Reserve Bank under the provisions of the Banking Regulation Act, 1949 (As applicable to Cooperative Societies). The provisions of the Act are not applicable to a society if the paid up share capital and reserves of a co-operative society are less than one lakh rupees and /or if the deposits accepted by the society are not repayable on demand. Under the current legal environment, therefore, a co-operative society may enroll any number of members, receive deposits from the members, raise loans and receive grants from external sources. The cap on funds raised from the external sources in the case of a co-operative society registered under the Multi-State Co-operative Societies Act is ten times of the sum of its subscribed share capital and accumulated reserves and in the case of those registered under the State Acts, the cap is prescribed in the byelaws of the society. The aforesaid position represents a regulatory gap which enables entities to raise public deposits without being subject to any prudential norms. The entire gamut of issues related to raising of funds, especially from external sources, by these entities needs to be examined.

**NETWORK ANALYSIS**

4.30 The previous FSR underscored the importance of developing strong analytical methods that help better identify, monitor and address systemic linkages. To further study the linkages amongst the scheduled commercial banks, an Integrated Communication Technology (ICT) based network model<sup>7</sup> has been developed to assess the degree of connectedness in the system and to analyse the possible domino impacts of bank failures.

***Structural aspects of the Indian interbank market***

4.31 For the entire analysis, bilateral data as on December 2010<sup>8</sup> has been used. The total gross value of these exposures amounts to around ₹ 6.9 lakh crore. An analysis of the network of net bilateral exposures reveals that, amongst the banking groups, on the aggregate, the public sector and the old private sector banks are the net lenders in the system while the new private sector and foreign banks are the net borrowers (Charts 4.10 to Chart 4.12).

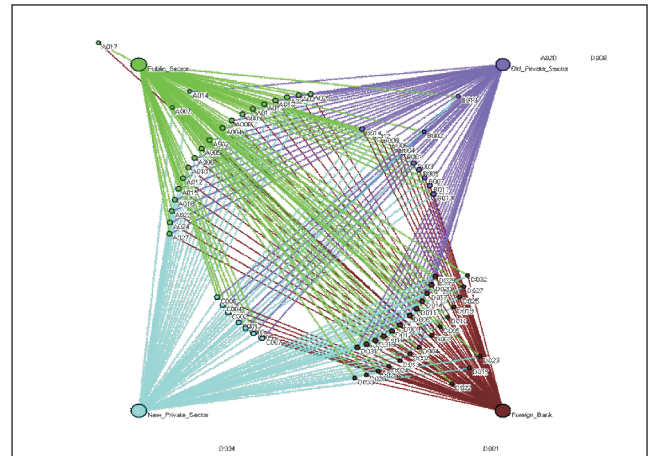
***The Indian banking sector- clustered and connected***

4.32 The Indian banking system is found to be substantially connected and clustered. Also, as evident from the central circular formation in chart 4.10, most banks have exposures to banks in all banking groups. The system has a total of 1514 edges (i.e., an aggregate of 1514 in degrees and out degrees), a cluster coefficient of 42 per cent and connectivity of 27 per cent (Box 4.4).

***Contagion Analysis – A stress test scenario***

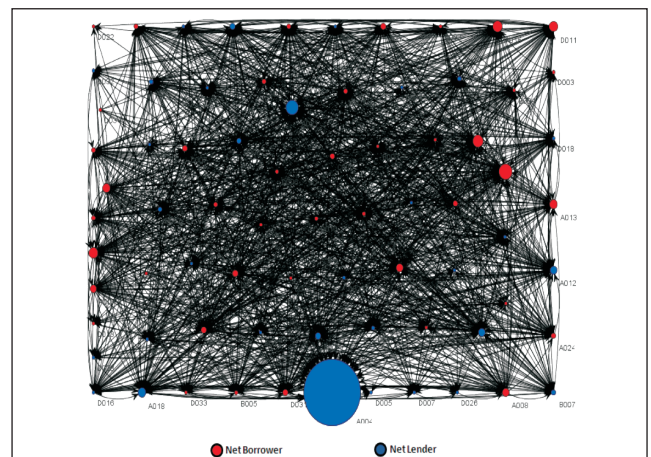
4.33 The above mentioned network model of bilateral exposures can be used to model the impact of bank failures. The contagion analysis (Box 4.4) works on the basic principle that all net lenders to a failing bank (trigger bank at the centre of the contagion chart) will get affected in the first round

**Chart 4.10: Bipartite Representation of Bank Lending in Four Banking Groups**

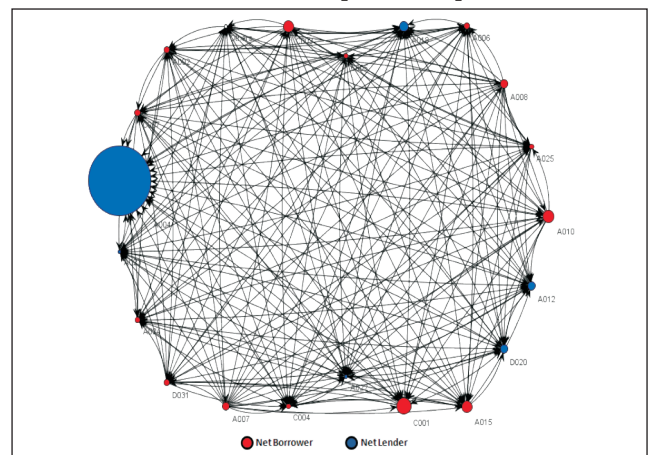


**Colour coding:** Green (Public Sector Banks); Purple (Old Private Sector Banks) Cyan (New Private Sector Banks); and Brown (Foreign Banks)

**Chart 4.11: Net Bilateral Exposures of All Banks<sup>9</sup>**



**Chart 4.12: Net Bilateral Exposure of Top 20 Banks<sup>10</sup>**



<sup>7</sup> 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.

<sup>8</sup> Bilateral data in respect of interbank exposures (both fund based and non fund based) for a sample of 75 scheduled commercial banks.

<sup>9</sup> The size of the node (bank) is rated by the number of in degrees, i.e., net lending.

<sup>10</sup> Top 20 banks are selected based on dominant eigenvalues (Box 4.4).

of contagion. Banks which come under distress<sup>11</sup> from an idiosyncratic event causing the failure of the trigger bank(s) will always have the potential to cause further damage in subsequent rounds of contagion. The contagion eventually ends when the system absorbs all the losses generated (Chart 4.13 and 4.14).

4.34 The impact as the result of failure of top 20 most connected banks, one at a time, and that of the failure of 10 pairs of banks, one pair at a time, are presented in Charts 4.15 to 4.16.

4.35 The above analysis clearly demonstrates the intertwined nature of the banking system in the country and leaves the system vulnerable to domino effects in case of idiosyncratic failure of one or more banks. The impact of such failures, in this model, would depend on how connected the bank is to other banks in the system as also its relationship with other banks (*e.g.* lender or borrower). The above analysis shows that the failure of the most connected bank in the system shaves off nearly 14 per cent of the banking system's core capital. The contagion impact is relatively contained due to regulatory limits on interbank exposures (*e.g.* limits on cross holding of capital amongst banks, limits on call money market exposures and prudential limits on interbank liabilities). The impact could be further aggravated if other entities in the financial system (other banks, NBFCs, Mutual Funds, *etc.*) are brought within the ambit of analysis. In any case, there remains need for continuous monitoring of the interconnectivities in the financial system to identify build up of risks/excesses in the system and to guide policy action to address the same.

Chart 4.13: Impact of Failure of One Trigger Bank<sup>12</sup>

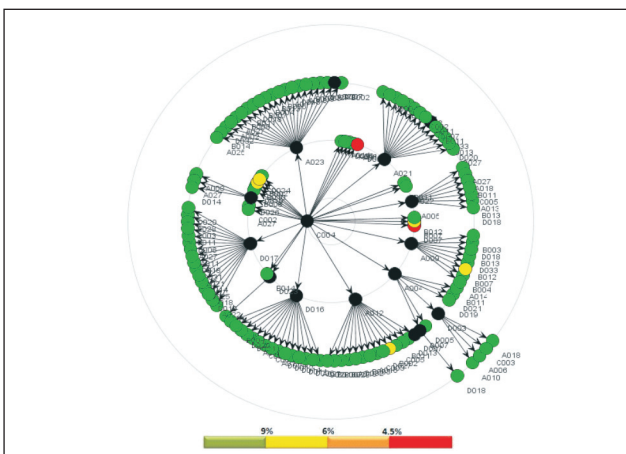
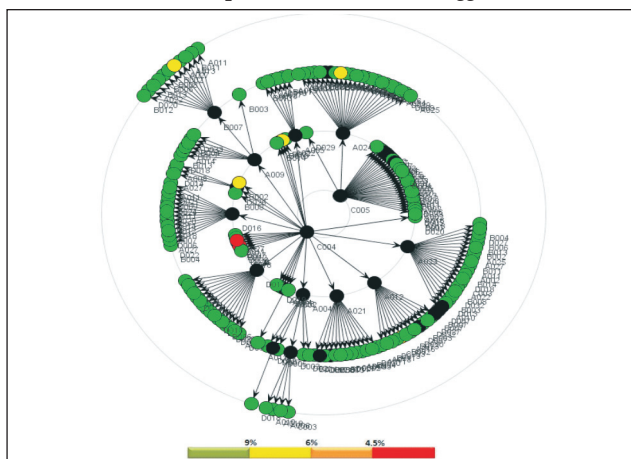


Chart 4.14: Impact of Failure of Two Trigger Banks



<sup>11</sup> For the purpose of the analysis, banks whose ratio of Tier I capital to Risk Weighted Assets falls below 6 per cent are considered to be distressed.

<sup>12</sup> Colour code:

**Trigger banks:** Black

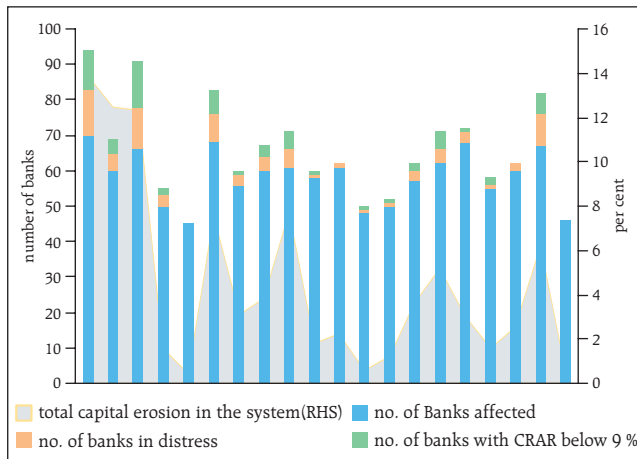
**Distressed banks:**

- (i) Black: Banks whose core capital ratio falls below 6 per cent
- (ii) Orange: Banks whose total capital adequacy ratio falls below 6 per cent
- (iii) Red: Banks whose total capital adequacy ratio falls below 4.5 per cent

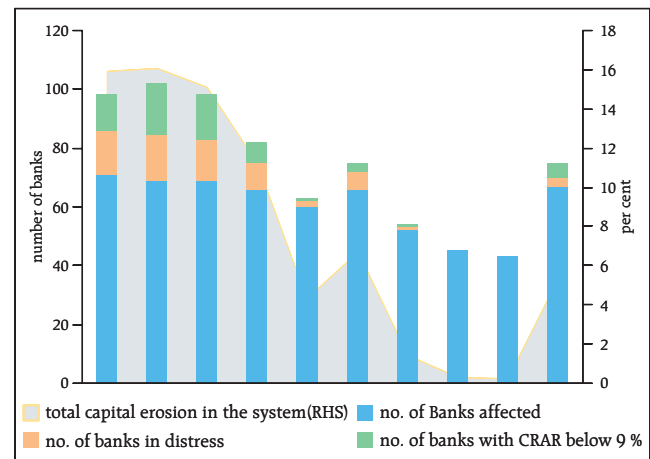
**Banks which are affected but not distressed:**

- (i) Green: Banks which are affected by the failure of the trigger /distressed banks but whose capital adequacy remains above regulatory requirements
- (ii) Yellow: Banks which are affected by the failure of the trigger /distressed banks and whose capital adequacy falls below 9 per cent but core capital ratio remains above 6 per cent

**Chart 4.15: Impact of the Failure of Top 20 Banks (One at a time)**



**Chart 4.16: Impact of the Failure of Ten Pairs of Trigger Banks (One pair at a time)**



**Box 4.4: Network Analysis of the Indian Interbank Market – Analytics and Methodology**

At the core of the analysis is matrix algebra, wherein the links or the relationships in the form of lending and borrowing, which exists between N banks are viewed in an N x N matrix. In a system of linkages modelled by undirected graphs, these relationships produce a symmetric matrix, as a link between two banks will produce the same outcome whichever of the two banks initiated it. In contrast, directed graphs are useful to study relative asymmetries and imbalances in link formation and their weights. For the network analysis, directed graphs have been used, as we aim to model banks as having complete discretion over the initiation of any link that they may choose to form.

Key to the network topology is the bilateral relations between banks which is represented by an adjacency matrix. The adjacency matrix becomes the gross flow matrix X such that  $x_{ij}$  represents the flow of gross financial obligations from the borrower i to the lender j. A bilaterally netted matrix M with entries  $(x_{ij} - x_{ji})$  is then derived from the matrix X. The matrix M, which is skew symmetric to the matrix X, gives the netted position between banks i and j. For the contagion analysis, the matrix M representing the net payables and receivables of all the banks in the network topology, is the critical feature. The number of links or directions representing net receivables for a bank (node) from others is referred to as *in degrees* and the number of links or directions representing net payable as *out degrees*.

**Connectivity statistics**

Statistical analysis is subsequently carried out on the aforesaid matrix to determine the level of interconnectedness and activity that exists in the system. Some of these tools that are used are as follows.

- (a) **Connectivity:** This is a statistic that measures the extent of links between the nodes relative to all possible links in a complete graph. For a directed graph, denoting the total number of out degrees to equal  $K = \sum_{i=1}^N k_i$  and N as the total number of nodes, connectivity of a network is given as  $\frac{K}{N(N-1)}$ .
- (b) **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 to each other. A high clustering coefficient for the network corresponds with high interconnectedness prevailing in the system.

- (c) **Average Path Length:** This is used to measure the distance that exists between any two nodes in the network.
- (d) **Shortest Path Length:** This gives the average number of directed links between a node and each of the other nodes in the network. Those nodes with the shortest path can be identified as hubs in the system.
- (e) **In-betweenness centrality:** This statistic reports how shortest path lengths pass through a particular node.
- (f) **Eigenvector measure of centrality:** Eigenvector centrality is a measure of the importance of a node (bank) in a network. It describes how connected a node's neighbours are and attempts to capture more than just the number of *out degrees* or direct 'neighbours' a node has. Hence, if two nodes have the same number of neighbours, then the one that is likely to have a higher eigenvector centrality is the node whose neighbours have the larger number of neighbours. This measure of centrality assigns relative scores to all nodes in the network based on the above principle. In general, for an N x N matrix there will be N different eigenvalues  $\lambda$  for which an eigenvector solution exists. For the centrality measure, we take the dominant eigenvalue and the associated eigenvector. The  $i^{th}$  component of this eigenvector then gives the centrality score of the  $i^{th}$  bank in the network.

**Contagion analysis**

The contagion analysis is basically a stress test where the gross loss to the banking system owing to a domino effect of one or more bank failing is ascertained. We follow the round by round or sequential algorithm for simulating contagion that is now well known from Furfine (2003). Starting with a trigger bank i that fails at time 0, we denote the set of banks that go into distress at each round or iteration by  $D^q$ ,  $q=1, 2, \dots$ . For this analysis, a bank is considered to be in distress when its core CRAR goes below 6 per cent.

**PAYMENT AND SETTLEMENT SYSTEMS**

***Regulatory arrangements for payment and settlement systems***

4.36 In India, the Reserve Bank is tasked with the regulatory oversight of the payment and settlement systems in the country. The legal framework for the oversight role of the Reserve Bank is provided by the Payment and Settlement Systems (PSS) Act, 2007 and the Payment and Settlement System Regulations, 2008 framed there under.

***Commodity spot exchanges – a gap in the perimeter of regulation***

4.37 The previous FSR also outlined some of the gaps in regulatory perimeter, in particular, the fact that some payment systems *viz.*, stock exchanges and clearing corporations set up under stock exchanges, remain outside the purview of the PSS Act. Also important in this connection is the functioning of the spot commodity exchanges. These exchanges facilitate purchase and sale of specified commodities, including agricultural commodities, metals and bullion by providing spot delivery contracts in these commodities. This market functions like the cash segment in equities and provides facilities such as clearing and settlement of trades on guaranteed multilateral netting basis. At present, there are four such exchanges functioning in the country.

4.38 An issue arises in the context of the clearing and settlement services offered by the spot exchanges which are currently not regulated under the PSS Act, 2007 or under any other regulatory arrangement.

***Operational performance of the payment and settlement systems***

***Operational Performance remains robust***

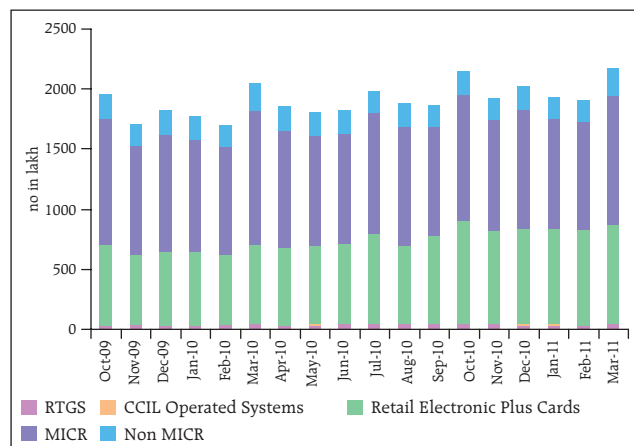
4.39 The operational performance of the payment and settlement infrastructure in India continues to be robust with no major disruptions to the payment and settlement process (Charts 4.17 and 4.18).

***Progress in migration to electronic clearing modes continued***

4.40 Paper based payment instruments continued to be widely used with their share in the Indian payment system constituting 59 per cent in terms of volume.

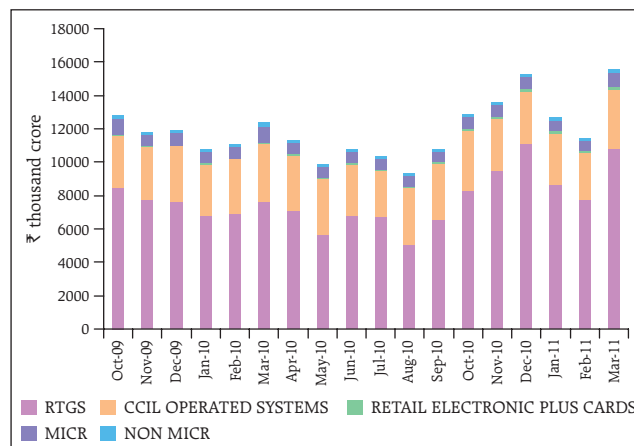
However, in terms of value, their share was only 10 per cent. Recent initiatives such as the introduction of time window for hourly settlement of NEFT transactions, the introduction of a system of positive confirmation to the beneficiary, extending NEFT to Regional Rural Banks (RRBs) and reducing the settlement cycle of ECS operations are aimed at expanding the reach of electronic clearing systems and can be expected to facilitate further migration of transactions to the electronic mode.

Charts 4.17: Trends in Volume



Source: RBI.

Charts 4.18: Trends in Value



Source: RBI.

***Operational risks closely managed and vulnerabilities monitored***

4.41 Management of operational risks in payment and settlement systems has been a key priority for the Reserve Bank. The Reserve Bank has three data centres – two on-city (Mumbai) and one off-city - which ensure that sufficient redundancies are available in case of any disaster at any critical region/installation. Regular disaster recovery drills test the resilience of the systems. Live operations of the payment and settlement systems were carried out from the off city centre on three occasions during the half year ended March 31, 2011. The member institutions participated in the drills from their primary sites. Issues such as slow network response /intermittent connectivity loss in some centres, revealed by the drills, were taken as feedback for necessary follow up/ corrective action.

4.42 Vendor concentration was observed in some of the activities like hardware and software maintenance in the core banking solutions being used by scheduled commercial banks and in certain ATM services outsourced by banks.

***Settlement of large value transactions***

4.43 For the management of settlement and other risks in payment and settlement systems in the country, the approach adopted by the Reserve Bank has been to migrate the settlement of all large value transactions to the Real Time Gross Settlement (RTGS) system or to deferred net settlements. For most critical systems, the settlement takes place on guaranteed basis through a central counterparty (CCP). While Clearing Corporation of India Limited (CCIL) acts as the CCP for money, government securities and foreign exchange markets in the country, there are other CCPs for equity and commodity markets. The previous FSR outlined several issues of concern with respect to the functioning of the CCIL including that of the design of CCIL as a multiproduct CCP, absence of a net debit cap in the CBLO segment, Herstatt risk in foreign exchange settlement, etc. A number of steps have been initiated to further strengthen the extant risk management practices in various segments including operationalisation of a default fund for the forex forward segment and

imposition of intra-day mark to market margin in the securities segment.

***Liquidity risks for CCPs in India remain – need to be addressed***

4.44 Liquidity risk is one of the major risks faced by CCPs. This has also been highlighted in a recent report on "Principles for financial market infrastructure"<sup>13</sup> which recommends that a CCP should effectively measure, monitor, and manage its liquidity risk. In fact, most well managed CCPs have developed various lines of defence– in the form of member margins, guarantee funds, non-member commitments and its own capital – to manage liquidity risks. There remains, however, the potential risk of a CCP default especially as the lines of defence may not be adequate in times of system wide stress. In any case, there are vulnerabilities arising from, *inter alia*, the quality of collateral being accepted by the CCP; competitive pressures leading to CCPs being incentivised to lower initial margins, accept a wider range of collateral or allow lower haircuts; and the inherent model risks arising from models which are relied on to produce valuations on which the margining system is based.

4.45 Some of these risks are evident in the Indian system as well, though CCPs in India are subject to a fair degree of regulatory oversight. In the case of CCIL, which is subject to both on-site and off-site supervision, there are dependencies for settlement on committed backup liquidity for funds and securities from financial institutions which are important market players and may not be able to provide the backstop liquidity during times of systemic stress. In the case of other CCPs operating in the country (for example the CCPs in the equity markets), there are vulnerabilities arising out of exposures to the banking sector as collateral in the form of bank deposits, bank guarantees, etc. are accepted in lieu of margins and contribution to guarantee funds. In any case, the collateral damage from the failure of a CCP, however unlikely, is too large for these risks to be left unaddressed.

***Access to central bank liquidity is one option; private sector bail in mechanisms could be explored***

4.46 The concerns in respect of liquidity risks of CCPs raise the issue of access of the CCP to central bank

<sup>13</sup> Joint CPSS-IOSCO consultative report on "Principles for Financial Market Infrastructure", March 2011 (<http://www.bis.org/publ/cpss94.htm>)

liquidity, which was flagged in the previous FSR. The matter is far from straightforward as the very expectation of a committed central bank support may, in fact, further perpetuate the same risks on account of the classical moral hazard problem. The provision of central bank liquidity could work on a case by case basis but, even then, central banks would require that the CCP is either regulated by it or, at the very least, it has access to all the relevant information about its risk management in order to assess the case and has the authority to request CCPs to implement changes to their risk management. In the Indian case, there is a further complication that not all CCPs are regulated by the central bank under the PSS Act.

4.47 With CCPs emerging as the preferred mode for settlement of transactions globally, the risks of creating a new set of "too big to fail" institutions are greater than mere tail risks, and arguably call for efforts to enhance the private sector bail-in mechanisms for CCPs, just as is being considered for systemically important banks.

#### **OTC markets**

4.48 Several issues and challenges facing the OTC markets in India, *viz.*, skewed participation structure, greater standardisation, introduction of central clearing, *etc.*, were highlighted in the previous FSR. These issues remain relevant especially as continuing low volumes in some derivative markets make it difficult to mandate guaranteed clearing for these markets.

#### ***A central repository for all products offers several advantages but raises governance issues***

4.49 A key shared priority amongst international policy makers is to ensure, *inter alia*, reporting of all OTC derivative products to a trade repository. Internationally, it is being argued that there should be a single repository worldwide for any given instrument. Otherwise, the aggregability of data will not be ensured and it may not be possible to get a clear picture of positions and exposures, particularly when two parties to a transaction are located in different jurisdictions. However, there is little discussion about whether there should be single repository for all products as well. Further, such repositories being public utilities, there is a strong case for them to function as "not for profit" entities.

#### **Existing reporting arrangements in the Indian context could be leveraged**

4.50 Unlike in most jurisdictions, where centralised trade reporting has come into focus only post-crisis, India has had arrangements for reporting of various OTC derivative transactions ranging from summary information to transaction level data. The Reserve Bank has been working closely with CCIL to develop various modules for transaction reporting. The existing reporting arrangements for OTC markets encompass foreign exchange, interest rate, government securities, corporate bonds and money market instruments. What is now needed is a consolidation of the reporting arrangements. Since CCIL has already developed the requisite platforms, it seems logical to leverage the advantages of economies of scale and scope, going forward. However, as CCIL also functions as a CCP, any such arrangement will need to address the governance issues relating to separation of trade repository function from the CCP function.

4.51 In this regard, a Working Group of the Reserve Bank has made several recommendations towards expanding the menu of products which are reported and requiring such reporting through regulatory mandates.

#### ***Portfolio compression – managing systemic risks in the OTC derivative markets***

4.52 The financial crisis of 2007-09 exposed the potential of OTC derivatives markets to contribute to the build-up of systemic risk. In the Indian context, the size of the derivative market remains limited and the product profile continues to be largely plain vanilla. Nevertheless, there remains potential for build-up of systemic risks given that there are very few active participants. With bilaterally negotiated early terminations being the only way to exit a position (besides entering into a trade with a opposite payoff), gross notional outstanding amounts multiply manifold leading to higher capital requirements and reduced availability of counterparty limits. More importantly, the gross notional values do not capture the economic essence of the portfolios.

4.53 The preferred solution internationally – that of migration to CCP settlement – does not apply in markets/products where, for different reasons, it is not feasible to introduce such arrangements. A solution being contemplated in some quarters for these markets/



products is portfolio compression - a market-wide exercise that reduces the overall notional size and number of outstanding contracts in OTC derivative portfolios without significantly altering the risk profiles of the individual portfolios. The process involves identification of trades which can be terminated early by all the counterparties such that the constraints/tolerance limits defined by each individual participant are satisfied. In the Indian context, CCIL is currently in the process of developing trade compression services for the rupee derivatives market.

**Interdependencies in the payment and settlements**

***Knock-on effects of interdependencies in payment systems could cause disruptions***

4.54 The risks of increasing interdependencies in payment system infrastructures and potential knock-on effects which could affect multiple systems due to their inter-linkages were highlighted in a recent report<sup>14</sup>. In the Indian context too, payment systems and related settlement flows, operational processes and risk management procedures are becoming increasingly interdependent. This increases the possibility of disruptions in any one system affecting the smooth functioning of other related systems and elevates the risk of disruptions to the entire payment and settlement infrastructure of the country due to an idiosyncratic event affecting any single system.

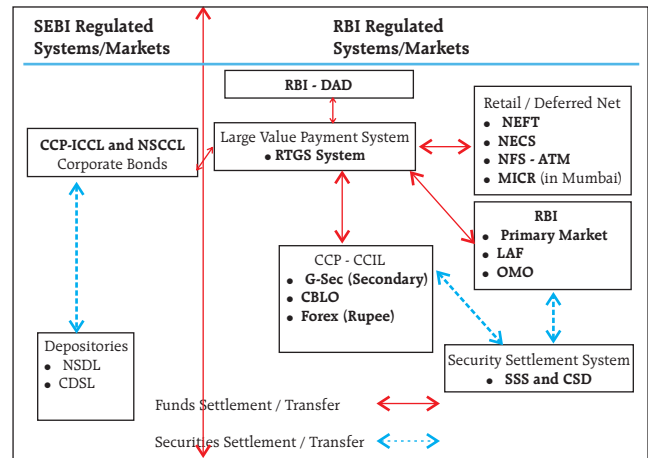
***There is strong evidence of system and institution based interdependencies in India***

4.55 Interdependencies, in the Indian context, include system based interdependencies arising from direct cross-system relationships, i.e. relationships between the Reserve Bank and CCIL operated systems, as well as with SEBI regulated clearing corporations which settle the funds leg of the corporate bond transactions in the RTGS system (Chart 4.19).

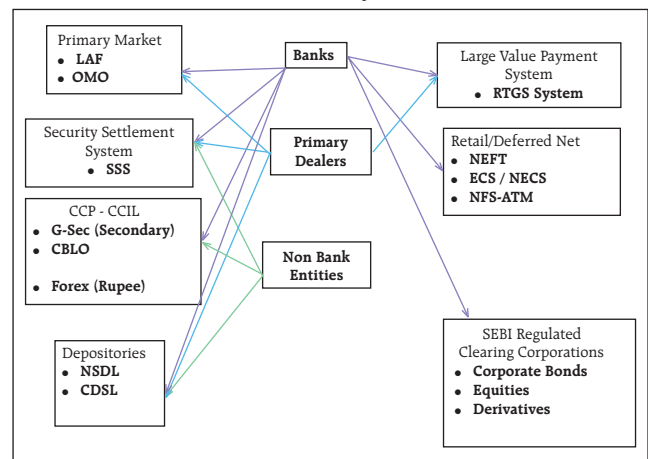
4.56 Again, there are institution-based interdependencies which result from indirect relationships between two or more systems through a common financial institution. In India, this is highly evident as all major financial institutions are participants in all systems. In addition, some major participants act as settlement banks for funds settlement for some other participants in the

CBLO and government securities segments. Again, some major banks in CCIL and Reserve Bank operated systems are settlement banks for the equity markets, while some provide funds and securities lines of credit to CCIL in segments in which they are also major players (Chart 4.20).

**Chart 4.19: Cross-system Linkages in the Indian Scenario**



**Chart 4.20: Common Participants in Various Payments and Settlements Systems**



<sup>14</sup> CPSS report: 'The interdependencies of payment and settlement systems', June 2008 (<http://www.bis.org/publ/cpss84.htm>)

4.57 Other forms of interdependencies also arise out of operational factors such as a financial institution acting as clearing bank for a system (as in the case of banks acting as clearing banks for the equity market CCPs) or because of providing common infrastructures (the INFINET network operated by IDRBT).

***A macro view of the risk management by interdependent systems is warranted***

4.58 Thus, the Indian payment system is a highly integrated and interdependent web of interrelationships, as is the case with most such systems across the globe. While these interdependencies have generated their own set of synergies leading to operational efficiency and also reduced risks (for example reduced credit risk due to DVP settlement in the RTGS system), the high level of integration and interdependency affects the settlement flows between various systems. It implies that credit and liquidity risks can spread very fast throughout the system. Disruptions in the payment and settlement systems could also affect the underlying financial markets. While arrangements such as settlement of transactions in key payment systems in central bank money, introduction of CCP settlement, *etc.*, have mitigated these risks to a great extent, there remains need for watchful management of the interdependencies. The risk management systems of each payment system have an important bearing on the overall containment of systemic risk and a macro view of these systems and their impact on systemic risk will be critical to manage the risks arising out of interdependencies in the payment systems.

**DEPOSIT INSURANCE**

4.59 The previous FSRs highlighted the importance of a strong deposit insurance system as an integral part of financial stability arrangements in any jurisdiction. The effectiveness of safety net systems was severely tested during the recent financial crisis and a large number of countries adopted policies to enhance depositor protection with a view to strengthen public confidence in the banking system. Exit from such special arrangements is one of the main challenges facing deposit insurance systems internationally. Deposit insurance agencies in different countries are also looking into ways to enhance the effectiveness of cross-border arrangements in order to reduce the adverse impact of bank failures in the home country on the host country.

Another policy initiative is aimed at providing for the proactive and early involvement of deposit insurance agencies in the resolution of weak/failing banks.

***Macro issues facing deposit insurance system in India remain relevant***

4.60 The previous FSR highlighted several issues and challenges facing the deposit insurance system in India. These, *inter alia*, include ensuring the adequacy of the deposit insurance fund, reducing the time taken to reimburse depositors, improving the coverage of the deposit insurance system, broadening the mandate of DICGC to include bank resolution, and ensuring compliance with the Core Principles for Effective Deposit Insurance Systems. These issues remain relevant. Meanwhile, DICGC has initiated steps to settle long-pending cases of settlement. The Corporation is also in the process of implementing an integrated claims management system aimed at improving data collection system and reducing time taken to settlement. However, one major reason for delay in reimbursing depositors - inadequate powers with the Corporation to ensure accountability of the liquidators – remains to be addressed. The fund ratio of the Corporation continues to remain low by international standards thus limiting the Corporation's ability to enhance coverage. Addressing issues relating to broadening the mandate of DICGC, though very important, will require sweeping changes in the legislative framework.

4.61 A Working Group on Reforms in Deposit Insurance is reviewing various issues, including adequacy of deposit insurance fund, broadening the mandate of DICGC, funds management and improving recovery performance.

**CONCLUDING REMARKS**

4.62 Significant strides have been made to strengthen the regulatory arrangements for the financial system, both internationally and domestically. Going forward, several issues and challenges are likely to emerge. Some banks may need to raise additional capital for funding credit growth and for meeting the requirements of Basel III. This may present difficulties given the sluggish performance of the equity markets. Amendments to banking sector legislations easing the access of nationalised banks to the capital market may alleviate this. Prescribed indicators for calibrating the

countercyclical buffers may not be appropriate in emerging markets like India and a mix of qualitative and quantitative indicators as well as a good dose of regulatory discretion will need to be employed for calibrating the buffers. Guidelines for migration to advanced approaches under Basel II have been issued and many challenges - availability of robust data and skilled personnel, need to develop internal rating systems to support the quantification of default and loss estimates, sound stress testing processes and validated risk models, *etc.* - are likely to emerge. Efforts are ongoing to improve the supervisory arrangements for FCs though issues such as orderly resolution remain germane.

4.63 The structure of the FSDC and its Sub-Committee attempts to strike a balance between the sovereign's objective of ensuring financial stability and the operative arrangements involving the central bank and other regulators. Legislative reforms to banking sector laws are expected to render the regulatory powers of the Reserve Bank more effective. Gaps in the regulatory perimeter for NBFCs and scope for regulatory arbitrage remain – a Working Group constituted by the Reserve Bank is examining the gamut of these issues. The exemption to Government sponsored NBFCs from Reserve Bank regulations needs to be revisited as the systemic importance of these entities have grown. The existing regulatory framework for wealth management activities and for structured products needs strengthening.

4.64 The Indian banking system is substantially connected and clustered, which leaves the system vulnerable to domino effects in case of idiosyncratic failure of one or more banks.

4.65 The clearing and settlement facilities offered by spot exchanges are currently not regulated in terms of the PSS Act, 2007 or under any other arrangement. Liquidity risks for CCPs in India, if they materialise, could have significant systemic impact. Access to central bank liquidity for CCPs is fraught with moral hazard risks and may necessitate efforts to enhance the private sector bail-in mechanisms for CCPs, just as is being considered for systemically important banks. A single repository for all OTC products offers several advantages. In the Indian context, existing reporting arrangements developed by CCIL for foreign exchange, interest rate, government securities, corporate bonds and money market instruments could be leveraged for the purpose. Introduction of a trade repository potentially paves the way for portfolio compression of derivative contracts with a view to reducing systemic risks. There is strong evidence of system and institution based interdependencies in the Indian payments systems implying that an idiosyncratic event affecting any single system can spread very fast throughout the entire system.

4.66 Issues related to ensuring the adequacy of the fund ratio of DICGC, reducing the time taken to reimburse depositors, improving the coverage of the deposit insurance system and broadening the mandate of DICGC to include bank resolution remain relevant and are being examined by a Working Group set up by DICGC.

## Chapter V

### Macrofinancial Stress Testing

*The relevance of systemic risk in the financial sector has been underscored by the global financial crisis. It is the risk of disruption to financial services that is (i) caused by an impairment of all or parts of the financial system and (ii) has the potential to have serious negative consequences for the real economy. The importance of the measurement of systemic risk in the financial sector is growing significantly. The importance of the measurement of systemic risk in the financial sector is growing significantly. In fact, measuring aggregate financial sector risk, i.e. the occurrence of a systemic event which would have severe implications not only on the stability of the financial system but also on the economy at large, has become one of the key area of research worldwide. Systemic risk measurement is clearly in its early stages of evolution. There are various approaches for the measurement of systemic risk and financial statement-based measures, exposure-based network models and measures based on capital market data are the prominent ones. However, these measures are not fully consistent and over-reliance on one measure may lead to biased inference. This requires a comprehensive approach to arrive at a conclusive decision by considering measures achieved through different methodologies.*

*Monitoring of financial stability indicators and conducting stress-testing exercises are the main practical approaches of macroprudential oversight. Stress testing is forward looking and can be tailored to the specifics of a given financial system. Stress tests are meant to evaluate the resilience of individual financial institutions and of financial sectors to highly adverse but plausible events. They are used to quantify vulnerabilities, both from a microprudential perspective within Supervisory Risk Assessments, where financial institutions are analysed individually, and from a macroprudential perspective within Financial Stability Analyses, where the resilience of the entire financial sector to adverse macroeconomic shocks is tested.*

5.1 In this report, the stability of banks has been studied through the Joint Probability of Distress (JPoD) and the Banking Stability Index (BSI), which takes into account the impact of one bank on others through direct or indirect links. Further, the resilience of the commercial banks in respect of credit, interest rate and liquidity risks were also studied through stress testing by imparting extreme but plausible shocks. A stress test on the projected balance sheet was undertaken for the commercial banking system which included both baseline and stressed scenarios. The credit risk of the commercial banks has also been tested through macro-stress test models, which link measures of credit risk to the macroeconomic variables using multivariate regression equation as well as a Vector Autoregressive (VAR) approach. Single factor sensitivity

analysis of credit risk of scheduled urban co-operative banks and non-banking financial companies were also conducted. The methodologies used in these stress tests are described in the Annex.

#### **Banking Stability Measures<sup>1</sup>**

5.2 During times of distress, the fortunes of banks typically decline concurrently through direct links or through indirect links which include mark-to-market asset values, interbank lending and information asymmetries. This section models distress dependencies as the financial system is conceptualised as a portfolio of a specific group of banks (Segoviano and Goodhart, 2009)<sup>2</sup>. In particular, the Banking System's Portfolio Multivariate Density (BSMD), which characterises both the individual and joint asset value movements of the

<sup>1</sup> This model for Indian banking system has been developed by Mr. Miguel A. Segoviano, CNBV (Comisión Nacional Bancaria y de Valores : Mexican financial Regulatory-Supervisory Agency).

<sup>2</sup> In this study twenty scheduled commercial banks have been considered comprising about seventy five per cent of total assets of commercial banks.

portfolio of banks, is recovered from the empirically observed Probabilities of Distress (PoDs) of the banks under analysis (Box 5.1 CIMDO-Approach)<sup>3</sup>. The BSMD embeds banks' distress dependence structure, which captures banks' linear (correlations) and non-linear distress dependence, and their changes throughout the economic cycle, reflecting the fact that dependence increases in periods of distress. By recovering the (entire) portfolio multivariate density that describes the system; the CIMDO-approach allows to analyse financial stability from three different, yet, complementary perspectives; *viz.*, (i) common distress of the financial institutions in

a system, (ii) distress between specific institutions, and (iii) distress in the system associated by distress in a specific institution. The possibility to analyse financial stability from complementary perspectives represents a key advantage over the analysis of any single perspective by providing policy makers with an enhanced set of information that might be useful to identify how risks are evolving, and where contagion might most easily develop. This methodology also offers great flexibility for implementation, since the PoDs of individual bank represent the input variables, which can be estimated using alternative approaches<sup>4</sup>.

### Box 5.1. CIMDO-Approach

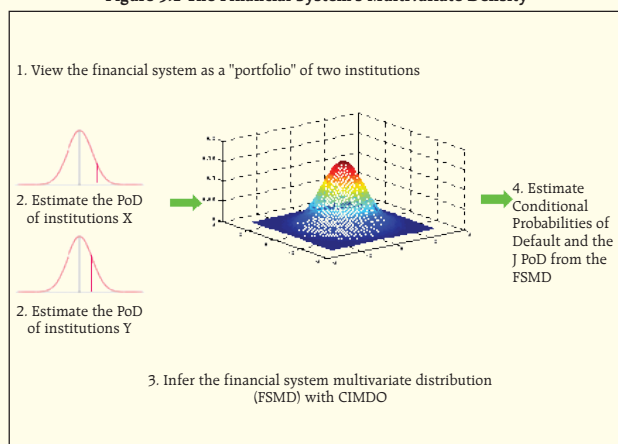
In modeling distress dependence, methodology described by Goodhart and Segoviano (2009) has been followed. First, the financial system has been conceptualised as a portfolio of institutions (FIs). Then, the PoD of the individual institutions, comprising the portfolio, has been inferred from equity prices (Figure 5.1). Subsequently, using as inputs (exogenous variables) such PoDs, and employing the Consistent Information Multivariate Density Optimizing (CIMDO) methodology (Segoviano, 2006), a novel non-parametric approach based on cross-entropy, the financial system's

portfolio multivariate density (FSMD) have been derived. Lastly, from the FSMD a set of conditional PoDs of specific pairs of FIs, and the financial system's JPoD are estimated.

The FSMD and thus, the estimated conditional probabilities and the JPoD, embed the institutions' distress dependence. This captures the linear (correlation) and non-linear dependencies among the FIs in the portfolio, and allows for these to change throughout the economic cycle. These are key advantages over traditional risk models that most of the time incorporate only correlations, and assume that they are constant throughout the economic cycle.

The distress dependence structure embedded in the FSMD is characterised by the CIMDO-copula (Segoviano, 2006). The structure of linear and non-linear dependencies among the assets in a portfolio can be represented by copula functions. This approach infers copulas directly from the joint movement of individual PoDs. This is in comparison to parametric copula approaches, in which parametric copula functions have to be chosen and calibrated explicitly—usually a difficult task, especially under data constraints.

Figure 5.1 The Financial System's Multivariate Density



Source: Goodhart and Segoviano 2009.

<sup>3</sup> The BSMD is recovered using the Consistent Information Multivariate Density Optimizing (CIMDO) methodology Segoviano Miguel (2006) which is a non-parametric framework based on the cross-entropy approach (Kullback, 1959). Segoviano Miguel (2006); Consistent Information Multivariate Density Optimizing Methodology, Financial Markets Group, London School of Economics, Discussion Paper 557.

<sup>4</sup> There are also other methodologies to estimate probabilities of distress (PoDs), notably using CAMEL ratings, Merton approach, *etc.* The PoDs for banks were estimated from their equity return distributions. Under this approach, first, banks' historical distributions of equity returns are estimated. Then, the probability of returns falling under the historical worse .05 per cent of the cases (99.5 VaR) is quantified. Therefore, the PoD of a specific bank represents the probability that the bank's equity return would fall in the worse.05 historical percentile.

**Common distress in the system: JPoD and BSI**

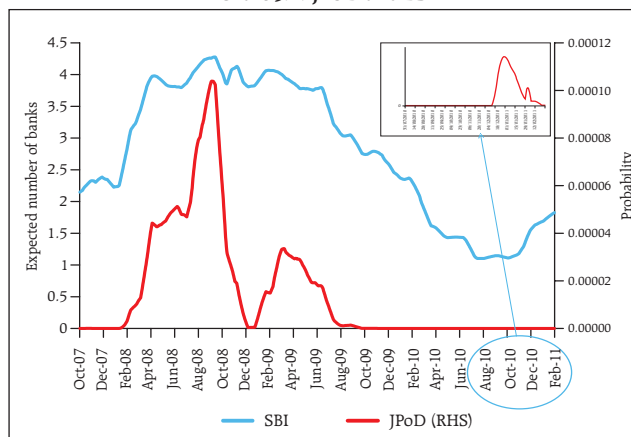
*Distress dependence down from crisis period, but cropping up again*

5.3 For the first perspective, two indicators, the Joint Probability of Distress (JPoD) and the Banking Stability Index (BSI) have been used<sup>5</sup>. The JPoD represents the probability of all the banks in the system (portfolio) becoming distressed. Whereas, BSI reflects the expected number of banks becoming distressed given that at least one bank has become distressed. The JPoD and BSI were estimated for the period from October 2007 up to February 2011 and are presented in Chart 5.1. It may be observed that the expected number of banks (out of the sample of 20) which was under distress was 4 during the crisis has declined to 1 by the last quarter of 2010. But, it has again increased to 2 during the first quarter of 2011. Distress dependence across banks rises during times of crisis, indicating that systemic risks, as implied by the JPoD and the BSI, rise faster than individual risks. The JPoD and the BSI not only take account of individual banks' probabilities of distress, but these measures also embed banks' distress dependence. Therefore, these measures may experience larger and nonlinear increases than those experienced by the probabilities of distress (PoDs) of individual banks. Chart 5.2 shows that daily percentage changes of the JPoD are larger than daily percentage changes of the average of individual PoDs. This empirical fact provides evidence that in times of distress, not only do individual PoDs increase, but so does distress dependence. Therefore, measures of financial stability that are based on averages or indices may not be able to indicate the proper estimates.

**Distress between specific institutions**

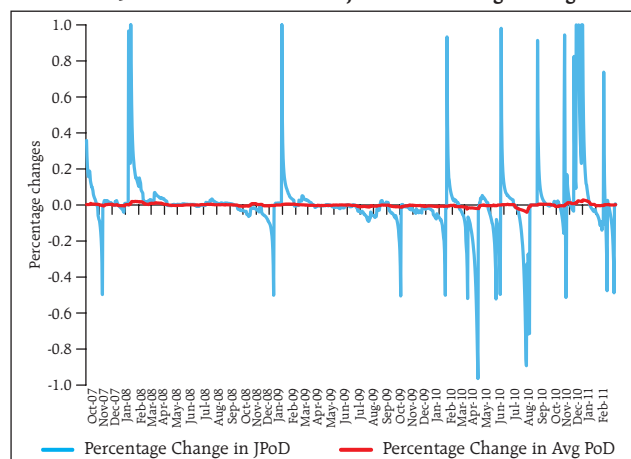
5.4 To analyse stability from the second perspective, a set of pair wise conditional probabilities of distress, have been estimated which are described as a Distress Dependence (DiDe) Matrix. The matrix shows the conditional probability of distress of the bank on a row given that the bank on the column falls in distress. The distress dependences are estimated daily. The distress dependency of a bank is analysed through a Toxicity Index which shows that if that bank is in distress what is the expected probability of it causing distress to another bank in the system.

Chart 5.1: JPOD and BSI



Source: Bloomberg

Chart 5.2: Individual PoDs and JPoDs : Percentage Changes



<sup>5</sup> See Segoviano and Goodhart (2009): Banking Stability Measures. IMF.WP/09/4 for definitions.

5.5 The distress dependence across major banks increased substantially (Chart 5.3). For the purpose of comparative analysis, October 10, 2007 and September 20, 2008 have been chosen to evaluate how conditional probabilities of distress evolved from an initial stage of the crisis to the aftermath of Lehman Brothers filing for bankruptcy. On average, if any of the banks fell into distress, the average probability of the other banks being distressed increased from 17 percent on October 10, 2007 to 42 percent on September 20, 2008. Moreover, on an average, distress of a specific bank would have caused the highest distress in the system (toxicity) in October 2007 (29 percent) while in September 2008, it would have been another bank that would have caused the highest toxicity (53 percent).

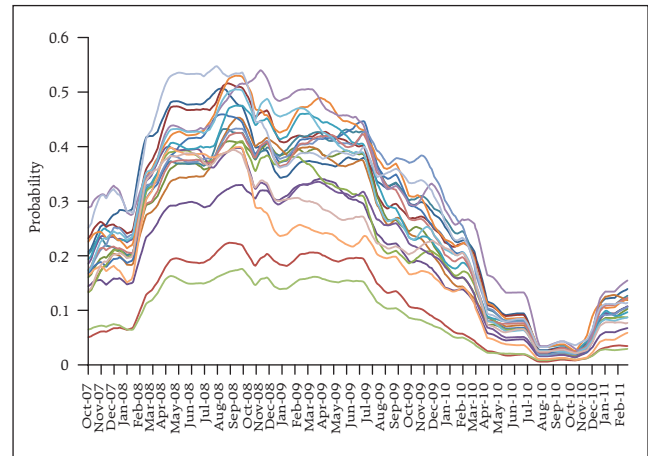
5.6 From the DiDe matrix, Vulnerability Index (VI), which quantifies the vulnerability of a bank given distress in the other banks in the system<sup>6</sup>, is derived and presented in Chart 5.4. It may be observed from the chart that the vulnerability of banks was high during the recent financial crisis but declined substantially during the subsequent period. Whereas, during the recent period, a marginal increase in vulnerability has been observed.

Even though distress dependence does not imply causality, these results show that the analysis of distress dependence, even several weeks prior to a distress event, can provide useful insights into how distress in a specific institution can affect other institutions and ultimately the stability of the system.

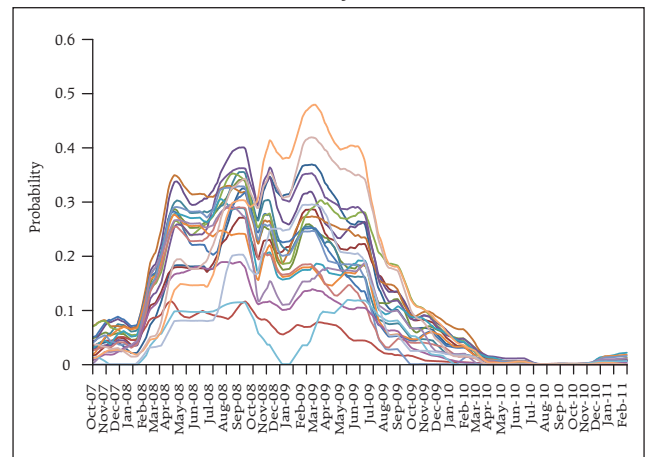
**Cascade Effects**

5.7 To analyse stability from the third perspective, the Probability of Cascade Effects (PCE) has been used. This represents the likelihood that one or more banks in the system become distressed, given a specific bank becomes distressed. Thus, this indicator is useful to quantify the systemic importance of a specific bank, if it becomes distressed, signaling the possible "domino" effects of that specific institution. Chart 5.5 shows bank-wise indicator across time for select banks. It is clear from the chart that cascade effect of select banks declined substantially after the crisis period.

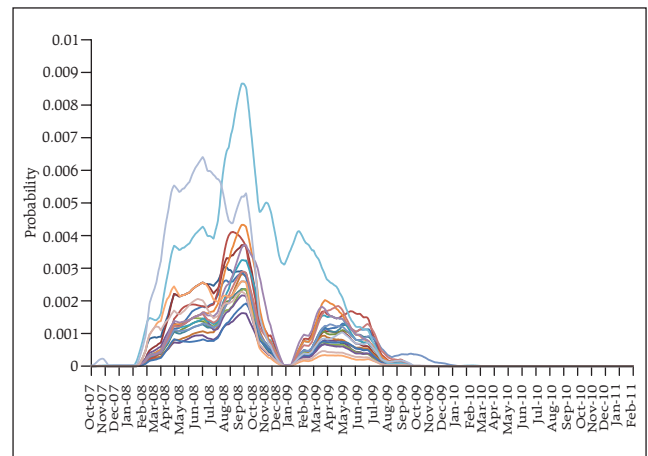
**Chart 5.3: Toxicity Index: Bank-wise**



**Chart 5.4: Vulnerability Index : Bank-wise**



**Chart 5.5: Cascade Effects : Bank-wise**



<sup>6</sup> For example for a system with three FIs, the VI for the financial institution A would be estimated as  $P(A/B)*P(B) + P(A/C)*P(C)$

**Credit Risk**

***Under stress conditions, profits lowered but not much pressure on capital adequacy***

5.8 A scenario analysis was undertaken for testing the credit risk using a balance sheet approach. The balance sheet and profit and loss account of the banks were projected for March 2012. Along with an enhancement in the provisioning requirements as proposed in the Monetary Policy Statement for the year 2011-12, the scenario framework also assumed that 30 per cent of restructured standard assets would turn into NPAs. Plausible shocks were administered on the projected financials of the banks to gauge their impact and the resilience of the system. The analysis was carried out both at the aggregate level as well as at the individual bank level based on supervisory data for March 2011.

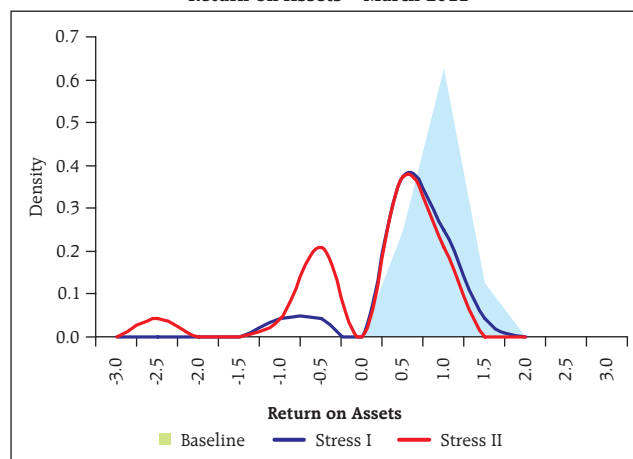
5.9 Under the stress condition, profitability of banks were adversely affected (Chart 5.6). The Return on Assets (RoA) density function under stress conditions shifted towards negative values indicating more and more banks unable to earn positive returns under the assumed stress conditions. However, the banking system was able to withstand an adverse NPA shock reasonably with their capital fund (Table 5.1). At end-March 2012, the projected system level CRAR remained at 11.27 per cent, while at individual bank level, except for one small bank, all banks maintained the CRAR above 9 per cent. The percentage of gross NPAs to total advances increased to 2.92 per cent as at end-March 2012 from 2.34 per cent as at end-March 2011 mainly on account of assumption of 30 per cent of restructured standard assets turning into NPAs. Under the most stringent credit quality shock of 150 per cent on the baseline, when the NPA level increased to 6.33 per cent, the system CRAR stood at 9.33 per cent. However, the system level CRAR was adversely affected under very extreme deterioration of asset quality, when the NPA rose by 168 per cent, impacting 25 banks having a share of 46.00 per cent in total assets, whose CRAR fell below 9 per cent.

**Interest Rate Risk - Duration of Equity**

***DoE at elevated level... Not much negative impact on capital, though***

5.10 Duration of Equity (DoE) of commercial banks, which shows extent of erosion in capital due to unit increase in interest rates, continued to remain at an elevated level, *albeit* a short detour, in recent quarters. This suggests active involvement of banks in managing interest rate risks (Chart 5.7). Further, the distribution

**Chart 5.6: Simulation of Stress Conditions: Change in Density of Aggregate Risk Indicator - Return on Assets - March 2011**



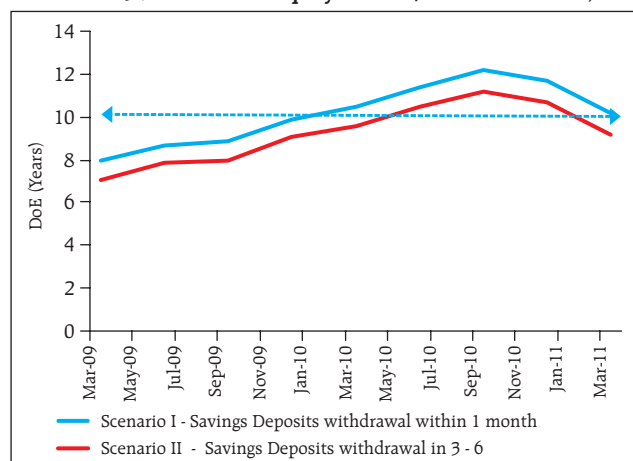
Source: Supervisory data and RBI staff calculations.

**Table 5.1 : Stress Test on Projected Balance Sheet**

|                                                                               | Gross NPAs per cent to Total Advances(%) | CRAR (%) | Number of banks whose CRAR falls below 9% | Share in total assets of banks whose CRAR falls below 9% (%) |
|-------------------------------------------------------------------------------|------------------------------------------|----------|-------------------------------------------|--------------------------------------------------------------|
| (1)                                                                           | (2)                                      | (3)      | (4)                                       | (5)                                                          |
| March 2011                                                                    | 2.34                                     | 13.09    | 0                                         | 0                                                            |
| <b>Projected Baseline: March 2012</b>                                         |                                          |          |                                           |                                                              |
| Baseline                                                                      | 2.92                                     | 11.27    | 1                                         | 0.15                                                         |
| <b>Assumed Stress Conditions: March 2012 Increase in NPA</b>                  |                                          |          |                                           |                                                              |
| 50 %                                                                          | 4.06                                     | 10.79    | 8                                         | 23.27                                                        |
| 100 %                                                                         | 5.19                                     | 10.15    | 15                                        | 34.58                                                        |
| 150 %                                                                         | 6.33                                     | 9.33     | 22                                        | 43.41                                                        |
| <b>Reverse Stress Testing: March 2012 Threshold Level (System level CRAR)</b> |                                          |          |                                           |                                                              |
| 168 %                                                                         | 6.74                                     | 9.00     | 25                                        | 46.00                                                        |

Source: Supervisory data and RBI staff calculations

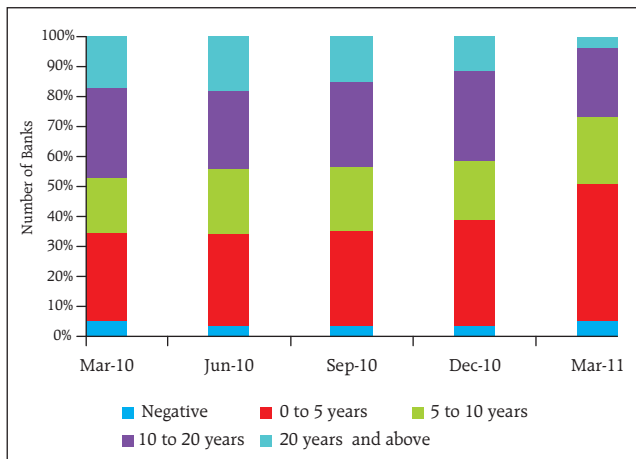
**Chart 5.7: Duration of Equity - Trend (Commercial Banks)**



Source: Supervisory data and RBI staff calculations.

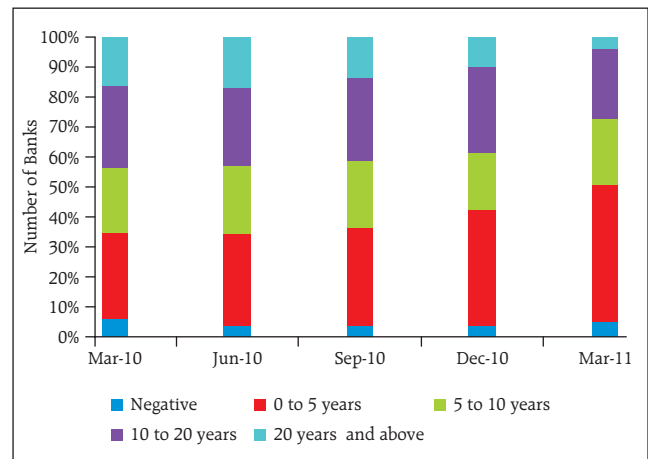


**Chart 5.8: Duration of Equity – Frequency Distribution (Scenario I - Savings Deposits withdrawal within 1 month)**



Source: Supervisory data and RBI staff calculations.

**Chart 5.9: Duration of Equity - Frequency Distribution (Scenario II - Savings Deposits withdrawal in 3 - 6 months)**



Source: Supervisory data and RBI staff calculations.

of DoE under the two scenarios showing movement of banks from higher duration to lower duration time buckets (Charts 5.8 and 5.9) indicates that the banks' vulnerability to increase in interest rate will not be very significant under normal conditions. On the balance, need for maintaining a lower level of DoE on sustained basis, may be a possible recourse available to the banks.

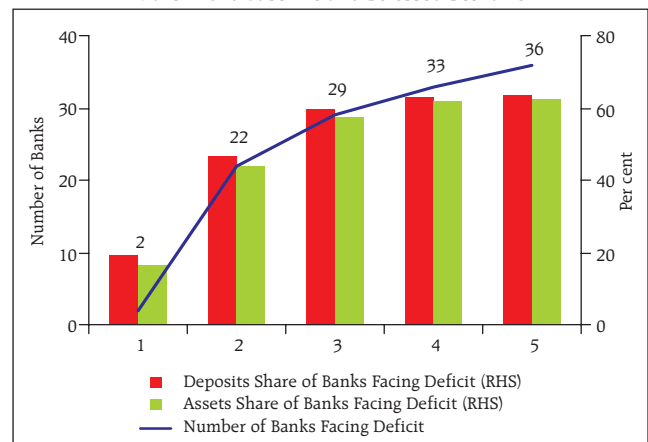
**Liquidity Risk**

***Lurking liquidity constraints under stringent stress scenarios while no potential strains at hand***

5.11 Liquidity stress tests showed that a few banks did not have adequate liquid assets to meet the withdrawals on the first day itself. The number of such banks increased in March 2011 as compared to March 2010. However, the total number of banks unable to withstand the stress scenario at the end of five days was higher in March 2010 (Charts 5.10 and 5.11) indicating a slight improvement of the position under the liquidity stress tests relative to the previous assessment.

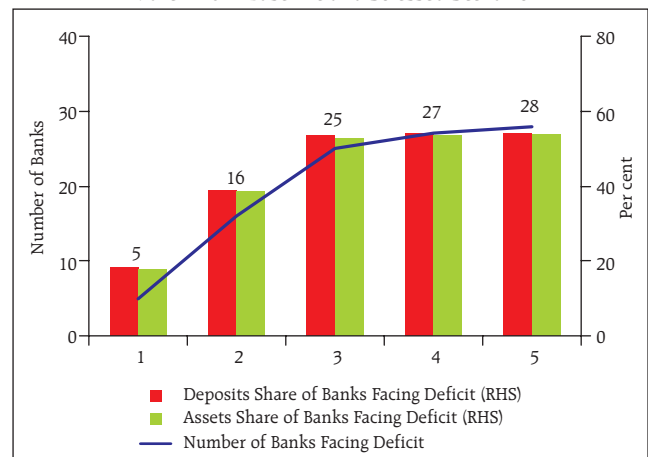
5.12 The analysis of liquidity of banks for the quarter March 2011 is also done using Liquidity Sustainability Ratio (LSR) which has been defined as (Liquid Assets/ Outflows in 1-14 days time bucket). Under the stress scenario the outflow is assumed to be increased by a factor of 3. In the baseline scenario only 5 banks had LSR less than 1, which increased to 29 banks under the stress scenario. These banks have to meet the outflow through purchased liquidity, which is expensive. Further,

**Chart 5.10: Liquidity Position of Banks: March 2010 Baseline and Stressed Scenario**



Source: Supervisory data and RBI staff calculations.

**Chart 5.11: Liquidity Position of Banks: March 2011 Baseline and Stressed Scenario**



Source: Supervisory data and RBI staff calculations.

under stress situation, with falling confidence, these banks may face extreme liquidity constraints showing signs of vulnerability for the system (Chart 5.12).

**Macro-stress tests: Multivariate Regression<sup>7</sup>**

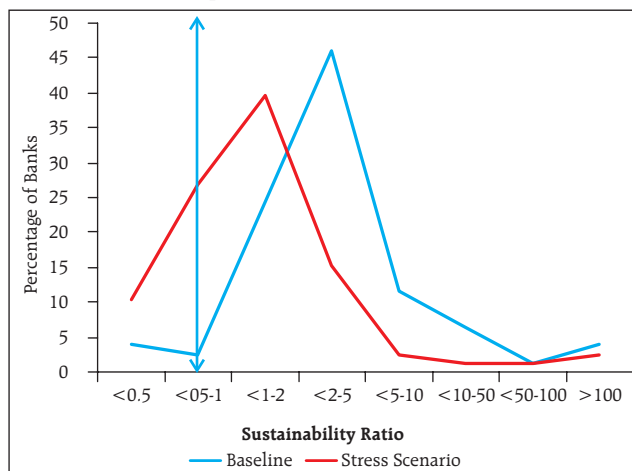
***Impact of macroeconomic shocks on banking sector not substantial***

5.13 The model based approach for the macro-stress test used a multivariate equation which directly links macroeconomic variables to measures of bank performance. The impact of macro variables on non-performing advances (NPAs), defined as ratio of gross non-performing advances to total advances, was estimated. The NPA-ratio was observed to be strongly auto-correlated. Though related negatively to agricultural and industrial GDP growth rates, it was seen to have positive relationship with short term nominal interest rate and inversely related to export-to-GDP ratio.

5.14 The model was used to forecast NPAs under the baseline as well as stress scenarios, with a stress test risk horizon of one year. The baseline and stress scenarios were constructed based on assumptions detailed in Tables 5.2 and 5.3.

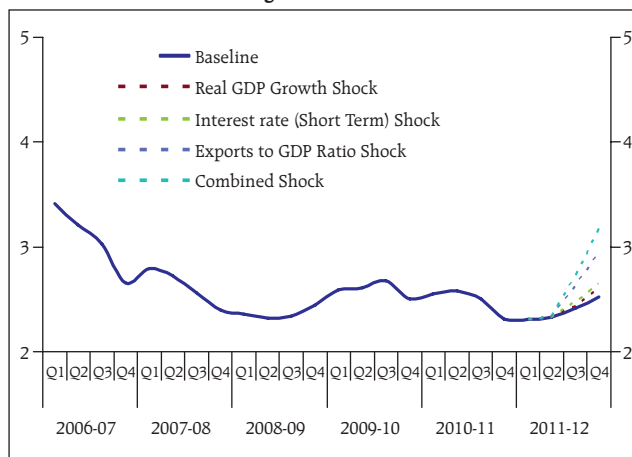
5.15 The results (Charts 5.13 and 5.14) show that impact of select macroeconomic variables, in the aforesaid macro-stress testing model, are not very significant. The results, under different scenarios, therefore, suggest that the macroeconomic shocks would not substantially threaten the Indian banking sector.

**Chart 5.12: Liquidity Sustainability Ratio: March 2011**



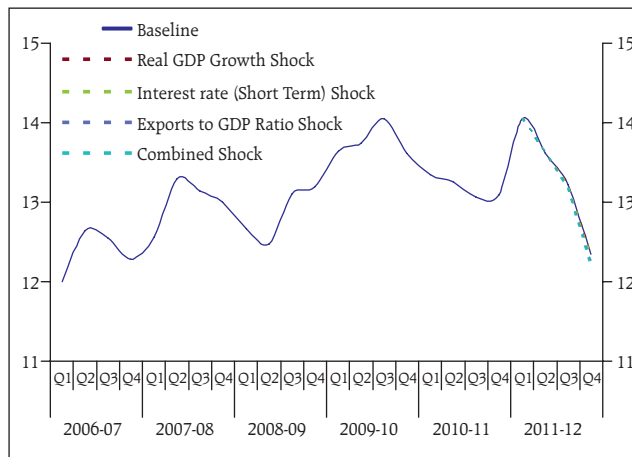
Source: Supervisory data and RBI staff calculations.

**Chart 5.13: Non-Performing Advances Ratio under Stress Scenarios**



Source: Supervisory data and RBI staff calculations

**Chart 5.14: Banks Capital Adequacy Ratios: Translated from NPAs under Stress Scenarios**



Source: Supervisory data and RBI staff calculations

| Forecast Period |    | Real GDP Growth | Nominal Interest rate (Short Term) | Exports to GDP Ratio |
|-----------------|----|-----------------|------------------------------------|----------------------|
| 2011-12         | Q1 | 8.00            | 7.00                               | 14.40                |
|                 | Q2 | 7.80            | 7.00                               | 14.30                |
|                 | Q3 | 7.30            | 7.00                               | 15.40                |
|                 | Q4 | 7.00            | 7.00                               | 15.60                |

| Time horizon | Shock level(basis points) |                                          |                            |
|--------------|---------------------------|------------------------------------------|----------------------------|
|              | Real GDP Growth Shock     | Nominal Interest Rate (Short Term) Shock | Exports to GDP Ratio Shock |
| 2011-12      | - 150                     | + 150                                    | - 300                      |

<sup>7</sup> i) Cihak, M. (2007). Introduction to Applied Stress Testing. IMF Working Paper WP/07/59.  
 ii) Juraj Zemen, Pavol Jurca (2008): Macro Stress Testing of Slovak Banking Sector. Working Paper 1/2008. National Bank of Slovakia.  
 iii) Marco, Sorge (2004). Stress-testing financial systems: an overview of current methodologies. BIS Working Papers No 165.  
 iv) Philippines: Financial System Stability Assessment Update (2010). IMF Country Report No. 10/90. April 2010.

**Macro-stress tests: VAR Model**

***With interest rates rising, loan losses may follow suit***

5.16 A vast body of literature endorses the fact that changes in macroeconomic conditions of any economy do impact banks' performance, simultaneously or with a lag. It is also possible that the feedback effects of bank instability on real economic activity could amplify the fluctuations especially during recessions. Therefore, in order to judge the resilience of banking sector to various macroeconomic shocks, Vector Autoregressive (VAR) approach has been adopted. The advantage of VAR model is that, it allows to fully capture the interaction among macroeconomic variables and banks' stability variable. It also captures the entailed feedback effect.

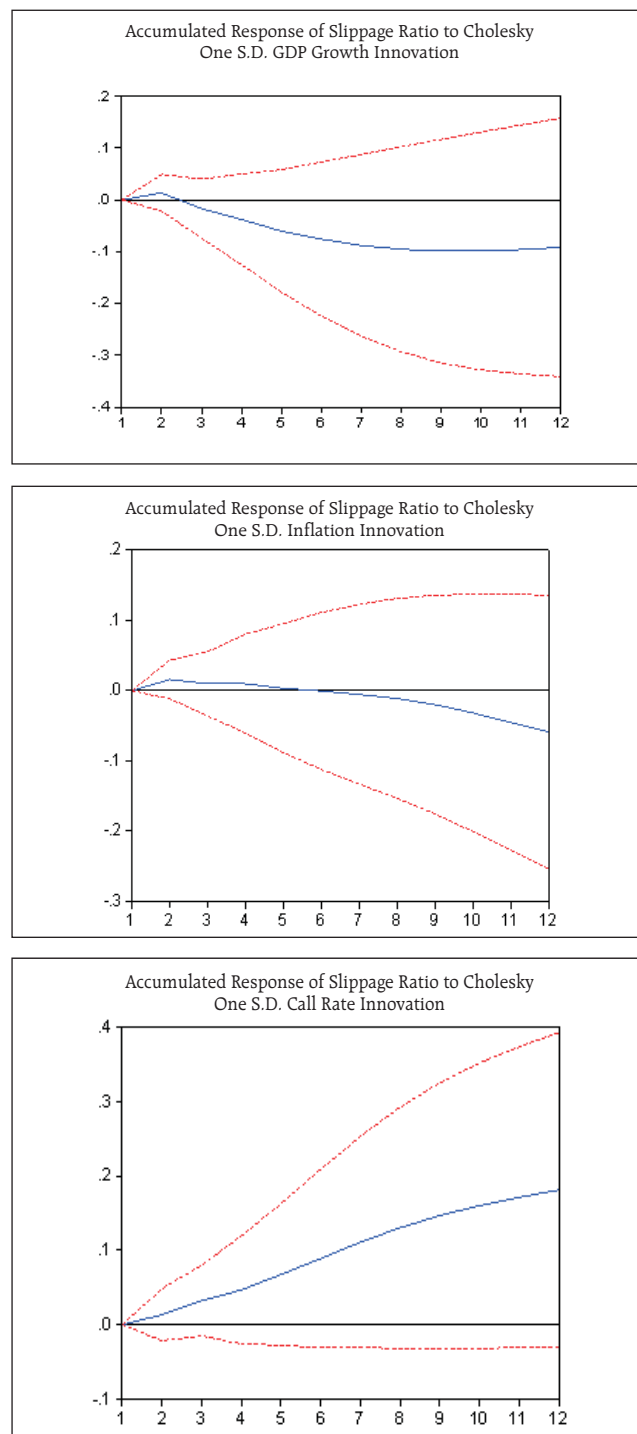
5.17 This exercise has been done using quarterly data since Q1 of 2001-02 to Q4 of 2010-11 on four macroeconomic variables, namely, GDP growth, inflation based on WPI, call money rate and Real Effective Exchange Rate (REER). Further, to reflect banks' stability, slippage ratio has been considered.

5.18 Based on the estimated VAR(2), the impulse response was generated. The accumulated response of slippage ratio to innovation in growth rate, inflation, call rate and REER is presented in the Chart 5.15. It is observed that one standard deviation (positive) shock to GDP growth will lead to decline in slippage ratio by 0.10 over a period of nine quarters. Though inflation has positive impact on slippage ratio, this impact was observed to be marginal: one standard deviation (positive) shock in inflation would raise the slippage ratio by 0.02 over two quarters. However, interest rate has not only significant impact on slippage ratio, such impact was also seen to be long lasting. One standard deviation (positive) shock in call rate tended to raise slippage ratio by 0.22 over twelve quarter. Whereas, REER had negative impact on slippage ratio, one standard deviation (positive) shock in REER prompted a fall in slippage ratio by 0.07 over six quarters.

***Under stress scenarios of lower GDP growth and higher rates of inflation & interest, NPA ratio would increase further***

5.19 Based on the impulse response function of the VAR, Gross NPA ratio was estimated under two stress scenarios and is presented in Table 5.4.

**Chart 5.15: Movement of Accumulated Impulse Response**



| Quarter | Baseline | Scenario I | Scenario II |
|---------|----------|------------|-------------|
| Jun-11  | 2.53     | 2.53       | 2.53        |
| Sep-11  | 2.69     | 2.71       | 2.74        |
| Dec-11  | 2.79     | 2.87       | 2.95        |
| Mar-12  | 2.95     | 3.13       | 3.31        |

*Scenario I: GDP growth will decline by 150 basis points (negative shock), WPI based inflation will increase by 150 basis points, interest rate will increase by 100 basis points and rupee will depreciate by 10 per cent (negative shock).*

*Scenario II: GDP growth will decline by 250 basis points (negative shock), WPI based inflation will increase by 250 basis points, interest rate will increase by 200 basis points and rupee will depreciate by 20 per cent (negative shock).*

The results indicated that under the baseline scenario, the Gross NPA ratio is expected to be around 2.95 per cent by March 2012 a rise of 64 basis points over the March 2011 figures, while under the extreme stress conditions, this ratio is projected to rise further to around 3.31 per cent.

5.20 It is observed from impulse response and variance decomposition that among all the four selected macroeconomic variables, viz., GDP growth, inflation, interest rate and exchange rate; interest rate has the highest (negative) impact on slippage ratio of the banks. This may have profound implications at this point of time considering the fact that stubborn inflation rate would prompt interest rates to keep on hardening impacting adversely asset quality of banks.

**Urban Co-operative Banks**

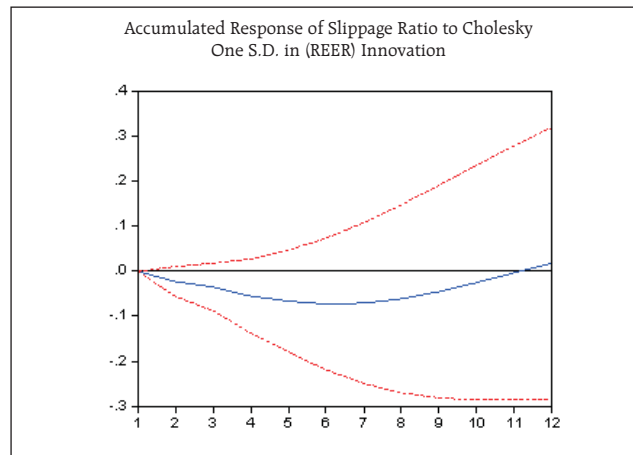
***Credit risk not alarming***

5.21 Stress tests on credit risk were conducted on Scheduled Urban Co-operative Banks (SUCBs) using their asset portfolio as at end-March 2011. The results are based on single factor sensitivity analysis. Impact of shocks on CRAR was tested under three different scenarios, which assumes (i) increase in NPA ratio by 50 per cent, (ii) increase in NPA ratio by 100 per cent and (iii) no profit earned by banks (Chart 5.16). It is observed that SUCBs could withstand shocks assumed under scenarios I and III easily. However, the sector would come under some stress under the stringent scenario II.

**Non-Banking Financial Companies (ND-SI)**

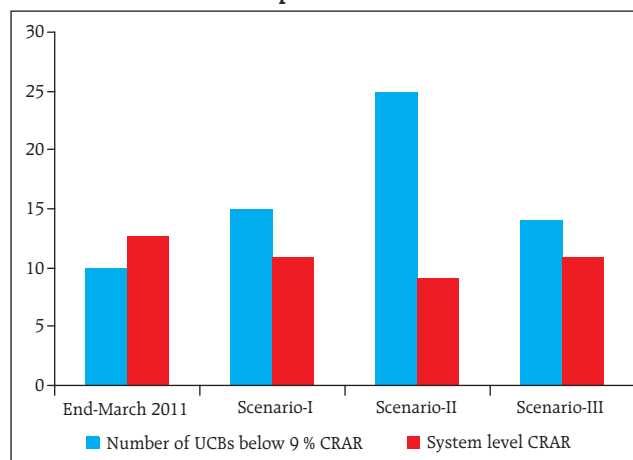
***Impact of credit risk on capital not very significant***

5.22 A stress test on credit risk for NBFC-ND-SI sector was carried out as on March 2010 under two scenarios (i) Gross NPA increased two times and (ii) Gross NPA increased 5 times from current level. It was observed



Source: Supervisory data and RBI staff calculations

**Chart 5.16 Stress Testing Scheduled UCBs: Impact of Shocks on Capital Position**



Source: Supervisory data and RBI staff calculations

that first scenario did not warrant any additional provision as the sector had excess provision towards NPAs while in the second scenario, it was observed that even though there was shortfall in provisioning the impact on CRAR was negligible as the sector had a higher level of CRAR of 37.1 per cent as against the required level of 12 per cent.

### ***Concluding Remarks***

5.23 Distress dependence across banks rises during times of crisis, indicating that systemic risks, as implied by the JPoD and the BSI, rise faster than individual risks. The distress dependence across major banks increased substantially during the global crisis period. The vulnerability of banks was high during the recent financial crisis but declined substantially during the subsequent period. However, during the recent period, a marginal increase in vulnerability has been observed for Indian banks. The cascade indicator quantifies the systemic importance of a specific bank, if it becomes distressed, signaling the possible "domino" effects of that specific institution. The cascade effect of select banks declined substantially after the crisis period.

5.24 Projected balance sheet analysis indicated that under stressful conditions, profitability of commercial banks may get adversely affected. However, the banking system would be able to withstand an adverse NPA shock reasonably easily because of its high capital levels. The interest rate risk through the Duration of Equity (DoE) method showed that the DoE continued to remain at elevated level, with an improvement in recent quarters, suggesting active involvement of banks in managing interest rate risks. Regarding liquidity stress test, under severe stress situation, when market sentiment is poor, some banks may face extreme liquidity constrain and may show a sign of vulnerability. The results of macro-stress test under different scenarios suggested that macroeconomic shocks would not substantially threaten the Indian banking sector. The VAR methodology indicated that in the current environment of stubborn inflation, which may prompt the interest to be hardened, the asset quality of banks may be impacted adversely. The credit risk stress tests on NBFC-ND-SI and scheduled UCBs revealed that the impact on CRAR under different scenarios would not be alarming.

### Annex: Stress Testing Methodologies

*As a part of quarterly surveillance, stress tests were conducted covering the following risks:*

- *Credit risk, which estimates the impact on capital adequacy by stressing the Non-Performing Advances (NPAs) for the entire credit portfolio. This was done using scenario analysis, multivariate regression model and Vector Autoregressive (VAR) approach.*
- *Interest rate risk, which estimates the erosion in economic value of the balance sheet for a given interest rate shock using the "Duration of Equity" method both at the system and the individual bank levels.*
- *Liquidity risk, using different scenarios, which include sudden withdrawal of deposits on account of loss of confidence due to adverse economic conditions.*

*The resilience of the commercial banks in response to the above shocks has been studied from the above three perspectives. The analysis covered all scheduled commercial banks. Single factor sensitivity analysis on credit risk of scheduled urban co-operative banks and non-banking financial companies were also conducted. The methodology adopted for the stress tests is in line with the stress tests conducted for the first FSR and second FSR and there is further evolution in a few methodologies.*

#### **Credit Risk - Scenario Analysis**

For scenario analysis, the balance sheet and profit and loss account of the banks are projected for March 2012. Plausible shocks are administered on the projected financials of the banks to gauge the impact and resilience of the system. The analysis is carried out both at the aggregate level as well as at the individual bank level based on supervisory data for March 2011. Under the assumed baseline scenario, the growth projection for balance sheet as well as profit and loss components are computed by applying compound growth rates as well as by using March 2011 proportions and applying adverse impact factors on them. The regulatory capital growth is assumed to remain at the minimum by assuming minimum mandated transfer of twenty five per cent of the profit to the reserves account. In addition to an enhancement in the provisioning requirements as proposed in the Monetary Policy Statement for the year 2011-12, it is also assumed that 30 per cent of outstanding restructured standards assets turn into NPAs. The baseline assumes that the existing loan loss provisioning coverage ratios remain intact. The result thus obtained in the baseline scenario is subjected to increase in NPAs by 50 per cent, 100 per cent and 150 per cent at the aggregate loan portfolio level for each bank. The systemic impact of such shocks is also worked out.

#### **Interest Rate Risk**

The duration of equity (DoE) or the net-worth duration approach in stress tests could help in calculating the erosion in capital due to unit increase in interest rates. The analysis takes into account the interest rate sensitive items in balance sheet of the banks' portfolio and also the off balance sheet items. Subject to certain limitations, DoE captures the interest rate risk and helps in moving towards the assessment of risk based capital. The higher the duration of equity, more is the interest rate risk and accordingly greater the requirement of capital.

- $\text{Duration Gap} = (\text{Duration of assets} * \text{total assets} - \text{Duration of liabilities} * \text{total liabilities}) / \text{total assets}$
- $\text{Duration of Equity} = \text{Duration Gap} * \text{Leverage Ratio}$   
 $= (\text{Duration of assets} * \text{total assets} - \text{Duration of liabilities} * \text{total liabilities}) / \text{Capital \& Reserves}$
- $\text{Interest rate shock required to wipe out the capital funds} = \% \text{ Change in Price} / \text{DoE} = 100 / \text{DoE}$

Under this approach, the duration of equity of a bank's portfolio is computed under two scenarios: the savings deposits are assumed to be withdrawn in the first time band *viz.* 1 to 28 days (scenario I); the savings deposits are assumed to be withdrawn in 3 to 6 months time band (scenario II). The time band-wise rate sensitive liabilities have been accordingly adjusted under the two scenarios.

### ***Liquidity Risk***

The aim of liquidity stress tests is to assess the ability of a bank to withstand unexpected liquidity drain without taking recourse to any outside liquidity support. The scenarios developed are based on very stringent assumptions, which are extreme. The analysis is done as at end-March 2011.

The scenario depicts different proportions (depending on the type of deposits) of unexpected deposit withdrawals on account of sudden loss of depositors' confidence and assesses the adequacy of liquid assets available to fund them. The deposit run is assumed to continue for five days.

- The objective is to capture the ability of the bank to meet unexpected withdrawal of deposits through sale of its available liquid assets without any outside support.
- Deposits are segregated into three types, current deposits, savings deposits and term deposits.
- Liquid assets consist of cash funds, excess CRR balances with the Reserve Bank, balances with other banks payable within one year and investments maturing within one year.
- Under the stress scenario the total unexpected withdrawal of deposits is assumed to take place in the following proportion:
  - Current deposits – three times the proportion of reported outflows of current deposits in 1-14 days time bucket.
  - Savings deposits – three times the proportion of reported outflows of savings deposits in 1-14 days time bucket.
  - Term deposits – two times the proportion of reported outflows of term deposits in 1-14 days time bucket.
- The bank is assumed to meet stressed withdrawal of deposits through sale of liquid assets.
- The sale of investments is done with a hair cut of 10 per cent of their market value.
- The stress test is done on a static mode.

Liquidity Sustainability Ratio = Liquid Assets / Outflows in 1-14 days time bucket

### ***Macro-Stress Test – Multivariate Regression***

To ascertain the resilience of banks, the credit risk was modeled as functions of macroeconomic variables. The analysis was carried out on ratio of non-performing advances to total advances at the aggregate level for the commercial banking system as a whole. With the help of the developed model the NPA ratio was forecasted for next few quarters. This included both baseline and stressed scenarios. On the forecasted values of NPAs, the capital adequacy ratios were derived keeping the existing loan loss provisions intact. The detailed methodology is described in the Financial Stability Report – December 2010.

### ***Macro-Stress Test – VAR Model***

A vast body of literature endorses the fact that the changes in the macroeconomic conditions of any economy do impact banks' performance, simultaneously or with lag. It is also possible that the feedback effects of bank instability on real economic activity could amplify the fluctuations especially during recessions. Therefore, in order to judge the resilience of banking on various macroeconomic shocks, Vector Autoregressive (VAR) approach has been adopted as done by Hoggarth, Sorensen and Zicchino (2005), Marcucci and Quagliariello (2005) and Renato Filosa (2007). The advantage of VAR model is that, it allows to fully capture the interaction among macroeconomic variables and banks' stability variable. It also captures the entailed feedback effect.

In notational form, mean-adjusted VAR of order p (VAR(p)) can be written as

$$y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + u_t ; t=0,1,2,3,\dots$$

Where,  $y_t = (y_{1t}, \dots, y_{Kt})'$  is a  $(K \times 1)$  vector of variables at time  $t$ , the  $A_i$  ( $i=1,2,\dots,p$ ) are fixed  $(K \times K)$  coefficient matrices and  $u_t = (u_{1t}, \dots, u_{Kt})'$  is a  $K$ -dimensional white noise or innovation process.

This exercise has been done using quarterly data since first quarter of 2001-02 to third quarter of 2010-11 on four macroeconomic variables, namely, GDP growth, inflation based on WPI, call money rate and Real Effective Exchange Rate (REER). However, to judge banks' stability, slippage ratio has been taken. Further, call rate, REER and slippage ratio were tested for seasonality and since seasonality was found in call rate and slippage ratio, these variables were adjusted for seasonality.

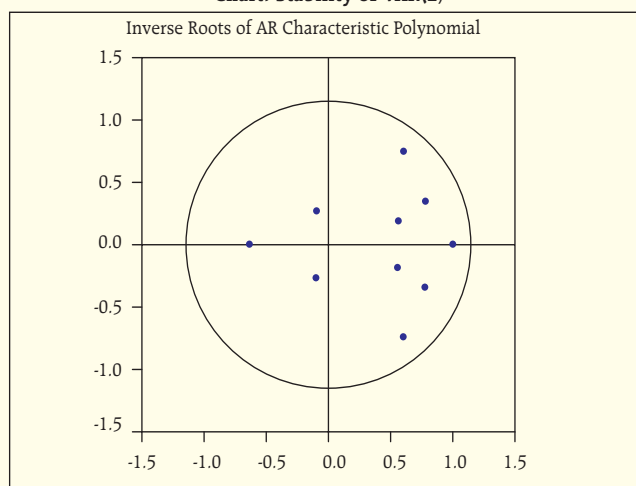
Stationarity of the variables was tested based on Augmented Dickey-Fuller Test. The null hypothesis that the variable has unit root was tested to be negative for slippage ratio, inflation, call rate and REER at 5 per cent level of significance and for growth at 10 per cent level of significance. Therefore, all the selected variables were found to be stationary.

**Table: Unit-Root test**

|                     | Slippage Ratio | Growth    | Inflation | Call Rate | REER      |
|---------------------|----------------|-----------|-----------|-----------|-----------|
| ADF Test Statistics | -3.102467      | -2.860975 | -5.486368 | -3.927392 | -3.291593 |
| P-value             | 0.0350         | 0.0595    | 0.0001    | 0.0044    | 0.0227    |

The appropriate order of VAR has been selected based on minimum information criteria as well as other diagnostics and suitable order was found to be two. Accordingly, VAR of order 2 (VAR(2)) was estimated and stability of the model was checked based on roots of AR characteristic polynomial. Since, all roots are found to be inside the unit circle, this selected model was found to be fulfilling the stability condition.

**Chart: Stability of VAR(2)**



**Urban Co-operative Banks – Credit Risk**

Stress tests on credit risk were conducted on Scheduled Urban Co-operative Banks (SUCBs) using their asset portfolio as at end-March 2011. The tests were based on single factor sensitivity analysis. The impact on CRAR was studied under three different scenarios. The assumed scenarios were as under:

Scenario I:

- Shock applied: 50% increase in gross NPAs.
- Provisioning requirement is increased by 50%.
- Capital (Tier I & II) is reduced by additional provisions.



## Scenario II:

- Shock applied: 100% increase in gross NPAs.
- Provisioning requirement is increased by 100%.
- Capital (Tier I & II) is reduced by additional provisions.

## Scenario III:

- Shock applied: Loss or Zero profit by all SUCBs due to adverse macroeconomic conditions.
- Capital (Tier I & II) is reduced by amount of profits in respect of those banks that reported profit (no change if reported loss).

***Non-Banking Financial Companies (ND-SI) – Credit Risk***

Stress tests on credit risk were conducted on Non-Banking Financial Companies (Non-Deposit taking and Systemically Important) using their asset portfolio as at end-March 2010. The tests were based on single factor sensitivity analysis. The impact on CRAR was studied under two different scenarios. The scenario assumed increase in the existing stock of NPAs by 200 and 500 per cent. The assumed increase in NPAs was distributed across sub-standard, doubtful and loss categories in the same proportion as prevailing in the existing stock of NPAs. The additional provisioning requirement was adjusted from the current capital position.