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Stability Analysis of the Banking Systems of Pakistan and India

by

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Stability Analysis of the Banking Systems of Pakistan and India

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*DEDICATED to My Wife a simple and gentle soul for providing all out support
Daughter Sadia Izhar and Daughter Safia Izhar for their continual support
Grandson Zain, and Granddaughter Zimal for rejuvenating my hopes in future
Father for his strong belief in honesty and hard work,
Mother for constantly praying for me*



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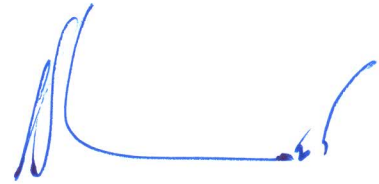
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List of Publications

It is certified that following publication(s) have been made out of the research work that has been carried out for this thesis:-

1. Izhar Muhammad & Arshad Hassan, (2017). "Stability Analysis of the Financial System of Pakistan" NUML International Journal of Business and Management. Vol. 12(2). Pp. 47-60

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Abstract

The objectives of this study are to assess the state of stability of the Banking systems of Pakistan and India and then to estimate how good, bad and worst economic conditions would influence its state of stability. Our design of study is a mix of the techniques used by independent analysts and financial system regulators. The model used in stress testing and scenario analysis are employed but in simplified form. Pakistan and India have not experienced financial crisis due to some shock/contagion, therefore stress events and its impact on macroeconomic indicators are not included in the design. Determinants of asset quality of commercial banks are determined and its influence on Nonperforming Loans (NPL) ratio explored empirically. A bank is termed unstable if its estimated Nonperforming Loans/advance ratio surpasses its equity/advance ratio during a year in a scenario. Scenarios of good, bad and worst economic conditions are developed for stress testing on the basis of extreme values of macroeconomic variables during sample period. Stability of whole banking system during a year in a scenario condition is evaluated on the basis of assets controlled by banks estimated unstable. First we take stock of banking system of Pakistan. During 1998-2001, in normal, bad and worst economic conditions, banks assessed significantly unstable are in control of maximum 35%, 50% and 62% assets respectively of the whole banking system. During 2002 and onward banks assessed significantly unstable are in control of maximum 6% assets of the whole banking system in normal, bad and even worst economic conditions. Thus it can be concluded that Pakistani banking system is stable since 2002 and can withstand bad and even worst economic conditions. As far as Indian banking system is concerned, Citibank (foreign bank) is the only bank appraised stable after 2006 and also adjudged able to withstand even the worst economic conditions. Almost all public sector banks reviewed are assessed unstable during 1999-2005. They exhibited signs of recovery during 2006-2011 but adjudged markedly unstable during 2012-14. During 2014, twelve (out of total thirteen) public sector banks are evaluated significantly unstable in bad economic conditions. The three private sector banks i.e. Axis, HDFC and ICICI are evaluated to have performed satisfactorily specially during the last four years

of the period under review. The instability of the Indian banking system in 2014 is more noteworthy when six banks possessing 30% assets of the banking system are appraised unstable by significant margin. The number of banks adjudged significantly unstable is (maximum) two during 1999-2013 but abruptly increases to six in 2014. Results of the stress testing of the banking system of India under various scenarios denote that Indian banking system lacks the potential to withstand any macroeconomic shocks. In any significant adverse macroeconomic conditions, the system is expected to collapse.

Keywords: Non performing loans, Bank specific factors, Industry specific indicators, Backtesting, Stress testing.

Contents

Author's Declaration	v
Plagiarism Undertaking	vi
List of Publications	vii
Acknowledgements	viii
Abstract	ix
List of Tables	xv
Abbreviations	xviii
1 Introduction	1
1.1 Background of the Problem	3
1.1.1 Overview of the Indian Banking System	8
1.1.2 Overview of the Pakistani Banking System	10
1.2 Statement of the Problem	13
1.3 Research Questions	14
1.4 Objectives of the Study	15
1.5 Significance of the Study	15
1.6 Plan of the Study	17
1.7 Limitation of the Study	17
2 Review of Related Literature	19
2.1 Review of Methodology	19
2.2 Stress Testing Approaches	21
2.2.1 Process of Stress Testing-Framework	22
2.2.1.1 Stress Test at Portfolio Level-Steps in Selecting a Model	24
2.2.1.2 Aggregate Stress Testing of Financial Systems	25
2.3 Stability Assessment by Independent Researchers	28
2.3.1 Macroeconomic Indicators and NPL Ratio	29

2.3.2	Bank Specific Factors (BSF) and NPL Ratio	33
2.3.3	Industry Specific Indicators and NPL Ratio	34
2.3.4	Macroeconomic Indicators and/or Bank Specific Factors and/or Industry Specific Indicators	34
3	Data Description and Research Methodology	43
3.1	Research Design	43
3.2	Banking Sectors of Pakistan and India Analyzed Separately	43
3.2.1	Steps of Research	44
3.3	Variables of Study	45
3.3.1	Variables	45
3.3.1.1	Dependent Variable-Non-Performing Loans/Gross Advances (NPL/Adv)	45
3.3.2	Independent Variable	46
3.3.2.1	Bank Specific Factors (BSF)	46
3.3.2.2	Industry Specific Indicators (ISI)	50
3.3.2.3	Macroeconomic Indicators (MEI)	51
3.4	Scope of Research	56
3.4.1	Population	56
3.4.2	Sample	56
4	Data Analysis and Results	59
4.1	Statement of the Problem Reviewed	59
4.2	Results of the Study-Pakistan	61
4.2.1	Results of Diagnostic Tests	61
4.2.2	Analysis of Results	65
4.2.2.1	Impact of Bank Specific Variables on NPL	65
4.2.2.2	Impact of Industry Specific Indicators on NPL	66
4.2.2.3	Impact of Bank Specific and Industry Specific In- dicators on NPL	67
4.2.2.4	Impact of Macroeconomic Indicators on NPL	67
4.2.2.5	Lag Effect of NPL/Advance on Itself	68
4.2.2.6	Impact of Bank Specific, Industry Specific and Macroe- conomic Indicators on NPL/Advance	69
4.2.3	Checking Robustness and Validity of the Model-Back Testing	70
4.2.4	Stability Assessment of Banks (1998-2014)	71
4.2.5	Stability Assessment of Overall Banking System 1998-2014	76
4.2.6	Stress Testing of Stability of Banks	79
4.2.6.1	Stress Testing of Banks-Normal Economic Condi- tions (Scenario 1)	79
4.2.6.2	Stress Testing of Banks-Bad Economic Conditions (Scenario 2)	82
4.2.6.3	Stress Testing of Banks-Worst Economic Condi- tions (Scenario 3)	84

4.2.7	Stress Testing of Stability of Overall Banking System	87
4.2.7.1	Stress Testing of Stability of Banking System in Normal Economic Conditions-Scenario 1	89
4.2.7.2	Stress Testing of Stability of Banking System in Bad Economic Conditions-Scenario 2	91
4.2.7.3	Stress Testing of Stability of Banking System in Worst Economic Conditions-Scenario 3	93
4.3	Results of the Study-India	95
4.3.1	Results of Diagnostic Tests	95
4.3.2	Analysis of Results	98
4.3.2.1	Impact of Bank Specific Variables on NPL	98
4.3.2.2	Impact of Industry Specific Indicators on NPL	99
4.3.2.3	Impact of Bank Specific and Industry Specific In- dicators on NPL	100
4.3.2.4	Impact of Macroeconomic Indicators on NPL	100
4.3.2.5	Lag Effect of NPL/Advance on Itself	101
4.3.2.6	Impact of Bank Specific, Industry Specific and Macro- economic Indicators on NPL/Advance	102
4.3.3	Checking Robustness and Validity of the Model-Back Testing	103
4.3.4	Stability Assessment of Banks 1999-2014	104
4.3.5	Stability Assessment of Overall Banking System 1999-2014	108
4.3.6	Stress Testing of Stability of Banks	111
4.3.6.1	Stress Testing of Stability of Banking System in Normal Economic Conditions-Scenario 1	111
4.3.6.2	Stress Testing of Banks-Bad Economic Conditions (Scenario 2)	115
4.3.6.3	Stress Testing of Banks-Worst Economic Condi- tions (Scenario 3)	118
4.3.7	Stress Testing of Stability of Overall Banking System	121
4.3.7.1	Stress Testing of Stability of Banking System in Normal, Bad and Worst Economic Conditions	121
5	Conclusion and Recommendations	126
5.1	Methods and Procedures	126
5.1.1	Research Design	126
5.1.2	Steps of Research	127
5.2	Major Findings	128
5.2.1	Banking System of Pakistan	128
5.2.2	Banking System of India	131
5.3	Some Noteworthy Findings of the Study	133
5.3.1	Noteworthy Findings of the Study (Pakistan)	133
5.3.2	Noteworthy Findings of the Study (India)	134
5.4	Directions for Future Research	134
5.5	Recommendations	136
5.6	Contribution of the Study	138

5.7 Limitations of the Study	139
Bibliography	140

List of Tables

3.1	List of Pakistan Banks Selected for Study.	57
3.2	List of Indian Banks Selected for Study.	58
4.1	Descriptive Statistic (Pakistan).	62
4.2	Multicollinearity Test (Pakistan).	64
4.3	Breusch-Godfrey Serial Correlation LM Test (Pakistan).	64
4.4	Correlogram Square Residual (Pakistan).	65
4.5	Impact of Bank Specific Variables (Pakistan).	66
4.6	Impact of Industry Specific Indicators (Pakistan).	66
4.7	Impact of Bank Specific and Industry Specific Indicators on NPL (Pakistan).	67
4.8	Impact of Macroeconomic Indicators on NPL (Pakistan).	68
4.9	Impact of Macroeconomic Indicators and NPL (lag 1) on NPL Ratio (Pakistan).	68
4.10	Impact of Macroeconomic Indicators and NPL (lag 1) on NPL Ratio (Pakistan).	69
4.11	Impact of Bank Specific, Industry Specific and Macroeconomic Indicators on NPL Ratio (Pakistan).	70
4.12	Results of Test for the Robustness of the Model (Pakistan)-Estimated NPL Minus Equity Ratios.	71
4.13	Stability Assessment of Banks 1998-2014 (Pakistan).	73
4.14	Results of Stability Assessment of Banks 1998-2014 (Pakistan).	75
4.15	Results of Stability Assessment of Banks 1998-2014 (Pakistan).	78
4.16	Stress Testing of Banks-Normal Economic Conditions (Scenario 1)-Pakistan.	80
4.17	Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-Scenario 1 (Pakistan).	81
4.18	Stress Testing of Banks-Bad Economic Conditions (Scenario 2)-Pakistan.	83
4.19	Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-(Scenario 2)-Pakistan.	85
4.20	Stress Testing of Banks-Worst Economic Conditions (Scenario 3)-Pakistan.	86
4.21	Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-(Scenario 3)-Pakistan.	88

4.22	Results of Stress Testing of Stability of Banking System-Scenario 1 (Pakistan)	90
4.23	Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-Scenario 1 (Pakistan)	90
4.24	Results of Stress Testing of Stability of Banking System-Scenario 2 (Pakistan)	92
4.25	Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-Scenario 2 (Pakistan)	92
4.26	Results of Stress Testing of Stability of Banking System-Scenario 3 (Pakistan)	94
4.27	Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-Scenario 3 (Pakistan)	94
4.28	Descriptive Statistic (India)	96
4.29	Multicollinearity Test (India)	97
4.30	Breusch-Godfrey Serial Correlation LM Test (India)	98
4.31	Autoregressive Conditional Heteroskesticity (ARCH) Test (India)	98
4.32	Impact of Bank Specific Variables (India)	99
4.33	Impact of Industry Specific Indicators (India)	99
4.34	Impact of Bank Specific and Industry Specific Indicators on NPL (India)	100
4.35	Impact of Macroeconomic Indicators on NPL (India)	101
4.36	Impact of Macroeconomic Indicators and NPL (lag 1) on NPL Ratio (India)	101
4.37	Impact of Macroeconomic Indicators and NPL (lag 1) on NPL Ratio (India)	102
4.38	Impact of Bank & Industry Specific and Macroeconomic Indicators on NPL (India)	102
4.39	Results of Test for the Robustness of the Model (India)	104
4.40	Results of Stability Assessment of Banks 1999-2014 (India)	106
4.41	Results of Stability Assessment of Banks 1999-2014 (India)	107
4.42	Results of Stability Assessment of Banking System 1999-2014 (India)	110
4.43	Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance (1999-2014)-India	110
4.44	Results of Stress Testing of Stability of Banks-Scenario 1 (India)	113
4.45	Unstable Banks during Normal Economic Conditions (Scenario 1)-India	114
4.46	Results of Stress Testing of Stability of Banks-Scenario 2 (India)	116
4.47	Unstable Banks during Bad Economic Conditions (Scenario 2)-India	117
4.48	Results of Stress Testing of Stability of Banks-Scenario 3 (India)	119
4.49	Unstable Banks during Bad Economic Conditions (Scenario 3)-India	120
4.50	Stress Testing of Stability of Banking System-Normal Economic Conditions (India)	122
4.51	Stress Testing of Stability of Banking System-Bad Economic Conditions (India)	122

4.52	Stress Testing of Stability of Banking System-Worst Economic Conditions (India).	123
4.53	Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-Scenario 1 (India).	123
4.54	Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-Scenario 2 (India).	125
4.55	Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-Scenario 3 (India).	125

Abbreviations

ABL	Allied Bank Ltd
BCBS	Basel Committee on Banking Supervision
BIS	Bank of International Settlement
BSF	Bank Specific Factors
BSR	Banking System Review
CAR	Capital Adequacy Ratio
CESEE	Central, Eastern and Southeastern European
CPI	Consumer Price Index
CNB	Czech National Bank
EAD	Exposure at Default
ECB	European Central Bank
EPS	Earnings per Share
FDI	Foreign Direct Investment
FDIGDP	Foreign Direct Investment as Percent of GDP
FSAP	Financial System Stability Assessment Program
FSR	Financial Stability Report
FWBL	First Women Bank Ltd
GDPDefl	GDP Deflator
GIPSI	Greece, Ireland, Portugal, Spain and Italy
GMM	Generalized Method of Moments
HBP	Habib Bank Ltd
IFIs	International Financial Institutions
IMF	International Monetary Fund
IRS	Interest Rate Spread

ISI	Industry Specific Indicator
LCs	Letter of Credits
LGD	Loss Given Default
MEIs	Macroeconomic Indicators
NBP	National Bank of Pakistan
NEER	Nominal Effective Exchange Rate
NII/TA	Net Interest Income/Total Assets
NIM	Net Interest Margin
NPL	Non-Performing Loan
NPLADV	Non-Performing Loans/Gross Advances
PD	Probability of Default
PSBs	Public Sector Banks
RBI	Reserve Bank of India
ROA	Return on Assets
ROE	Return on Equity
RWA	Risk Weighted Assets
SBI	State Bank of India
SBP	State Bank of Pakistan
UBL	United Bank Ltd
UnempR	Unemployment Rate
VIF	Variance Inflation Factors
WAIRD	Weighted Average Interest Rate on Deposits
WDI	World Development Indicator
XCH	Exchange Rate

Chapter 1

Introduction

European Central Bank (ECB) defines Financial stability as a situation in which the financial system is able to absorb shocks without any significant disruption in its key functions of financial intermediation¹. A financial system is said to be stable if it is capable of facilitating (and not impeding) the economic activity of a country and is able to dissipate imbalances arising endogenously or caused by significant adverse and unanticipated events (Schinasi, 2004). Reserve Bank of Australia defines a stable financial system as the one in which financial intermediaries facilitate the smooth flow of funds between savers and investors and thus help to promote economic activity. On the other hand, financial instability means a significant disruption in intermediation process i.e., flow of funds for investment². History is however, replete with incidences of financial crises causing extreme disruption in the normal functions of financial and monetary systems. France's financial sector crash of 1720 had for instance, paralyzed its financial system for years. In 1825, there was 'bank run' situation in Britain (Al-Assaf, Al-Tarawneh & Alawin, 2013). Great depression caused by speculative buying of stock and tight monetary policy resulted in fully pledged banking system crisis during 1933 (Bernanke, 1994). During the last 16 years, world economies have observed ten significant financial system crises. Asian financial crises started in

¹See European Central Bank Financial Stability Report, Nov 2015

²See World Bank Financial Stability Report, 2013

Thailand in 1997 by collapse of its currency 'baht'. Gradually the crisis proliferated to Indonesia, South Korea, Hong Kong, Laos, Malaysia, Philippines, Brunei, China, Singapore, Taiwan, and Vietnam (Claessens & Kose, 2013). The Russian financial crisis also called 'Russian Flu' jolted its economy during 1998 causing the country to default on its debt (Dinos and Ashta, 2010). In 2001, financial crisis hit Turkey triggering economic turmoil, causing unemployment of factors of production, poverty and depreciation of currency (Özatay and Sak, 2002). The dot com bubble was a collapse information technology companies during 1999-2001. As a result a great number of companies failed completely while others although survived but lost a large portion of their market capitalization (Kim, Shamsuddin, & Lim, 2011). Argentinean financial crisis during 1999-2002 also left a legacy of joblessness, homelessness, default on loans, record high rate of unemployment and poverty (Desai, 2014).

Global financial crisis 2007-08 is considered to be the worst crisis after 1930 great depression. This crisis also called subprime mortgage crisis (Demyanyk & Van Hemert, 2009), was triggered by subprime loans (Saunders & Allen, 2010; Shiller, 2012) and housing bubble in United States which spread to and affected almost all European economies (Lane, 2012). The crisis played a critical role in key businesses failure, reduction in consumer wealth worth trillions of U.S. dollars, a slowdown in economy leading to the 2008-12 global recession and the European Sovereign debt crisis (Reinhart & Rogoff, 2013). The Icelandic financial crisis of 2008 was another major economic event in Iceland involving the default of all its three major privately owned commercial banks, economic slowdown, deteriorating job market condition and declining incomes³. The European debt crisis also called Euro zone crisis or European sovereign debt crisis jolted European Union countries from 2009 to 2014 (Hall, 2010). Several member states of European Union like Greece, Portugal, Ireland, Spain, and Cyprus defaulted on their loans. These states were also unable to provide bailout packages to their national banks and therefore got financial assistance from other European Union and the International Monetary Fund (Lane, 2012). The Russian financial crisis started in the second

³The Economist, 11 December 2008

half of 2014. It was triggered by decline in the value of Ruble, and selling off Russian assets by investors (Iwasaki, 2014).

Frequent financial crises and default of banks in developed countries are symptomatic of the fact that concerned regulators and banks' management are aware of the state of stability of financial entities, but have kept failing to adjudge the robustness of the banks in the face of external and internal shocks of various intensities. International Financial Institutions, Central banks and other regulators of financial institutions have started monitoring the financial institutions for its tenacity to withstand shocks (Ingves, 2011). Financial systems of Pakistan and India have not been comprehensively analyzed for its tenacity to absorb macroeconomic shocks. A need is therefore felt to develop a model of stress testing and scenario analysis for studying the potential of financial systems of Pakistan and India to withstand unfavorable economic conditions.

Pakistan and India are developing economies. Both the countries have inherited the same legal framework, banking rules, procedural codes and have many commonalities in their business environment. Cost of doing business (interest rates and interest rate spread) is high in both the countries. Commercial banks are forced in both the countries to advance loans to specific sectors and business firms. Therefore, financial sectors of these countries are chosen for assessing its robustness to cope with tough economic conditions.

1.1 Background of the Problem

There is no widely accepted definition of financial stability of a financial system or financial institution (Galati & Moessner, 2014). Smaga (2013) conducted a study, surveying central banks of 27 European Union countries and found that six central banks (out of 27) had no objective definition of financial stability. The remaining 21 banks had defined financial stability in their own terms. An interesting finding of the study was that almost all banks had no final definition but had kept it changing in successive financial stability review. Deutsche Bundesbank interprets

financial stability as a state in which the financial system perform its main functions such as allocating resources, dissipating risk and settle payments efficiently, and is capable to do it even in the periods of profound structural change, internal and external shocks and stress situations⁴. This definition has taken the broad approach by taking all the characteristics i.e. resilience to shocks, smoothness in key functions, efficient allocation of resources etc. Bank of England defines financial stability in terms of degree of confidence of all stakeholders specially depositors in the financial system⁵. European Central Bank (ECB) defines Financial stability as a situation in which the financial system is able to absorb shocks without any significant disruption in its key functions of financial intermediation⁶. As per Australian National Bank financial stability is a condition in which the financial institutions perform its basic functions in a satisfactory manner, even in stressed situation⁷. The Czech National Bank (CNB)⁸ describes financial stability as a situation in which financial system is working with no undesirable effect on the development of the economy while exhibiting a high degree of potential to absorb shocks. According to Bank of Finland, a stable financial system is able to conduct its core functions of intermediation of financing, payments and settlement and allocation of risks smoothly. The bank further stresses that potential of major financial institutions must be high to withstand severe disruptions⁹. Central Bank of Sri Lanka describes financial system stability as safe and secure system, able to absorb external as well as internal shocks. As per Swiss National Bank a stable financial system is the one in which the individual components-financial institutions and market infrastructure performs its functions and is resistant to shocks. Central Bank of Iceland considers a financial system stable if it is able to mediate and redistribute risk and is robust enough to withstand macroeconomic and financial shocks¹⁰. As per Wellink (De Nederlandsche Bank), a financial system is stable if it is capable of allocating resources efficiently, withstanding shocks, protecting the

⁴Deutsche Bundesbank, 2013

⁵See Bank of England FSR 2014

⁶See ECB Financial Stability Review, Nov 2015

⁷See Australian National Bank financial stability report, 2014

⁸See banking reviews of Czech National Bank, 2014

⁹See banking reviews of Bank of Finland, 2014

¹⁰See banking reviews of Central Bank of Sri Lanka and Swiss National Bank, 2014

real economy and other financial systems from its disruptive effect (Alawode & Sadek, 2008). A stable financial system should not be a source of shocks itself (Desai, 2014). This definition implies that in a stable financial system money carries it functions as a unit of measurement and mode of payment effectively while the financial system itself performs the role of saving mobilization, risk diversification and resource allocation smoothly. To sum up financial instability can be defined in terms of shocks to the financial system which shatters the confidence of depositors and creditors affecting the financial system ability to channel funds from savors to investors (Alawode & Sadek, 2008). Conversely, a financial system is termed stable if all of its constituent financial institutions are robust enough to withstand shocks and function smoothly even in stressful macroeconomic conditions (Shiller, 2012). To summarize, almost all central banks have defined stability of a financial systems and institutions in terms of its tenacity to absorb economic shocks¹¹, smoothness of key functions and extent of trust reposed by depositors, creditors and other stakeholders¹². After financial crises during 2006 onward, there is however, a little shift of focus. ‘Resilience of a financial system to absorb shocks’ has attracted more attention of the analysts (Ingves, 2011).

A thorough review of the definitions discussed in the preceding paragraphs, it can be deduced that there is no unanimously agreed upon definition of financial stability (Smaga, 2013). However, the financial analysts and regulators have a convergence of opinion. To summarize there are two characteristics of a stable financial system. The first one is the ability of a financial system to perform its core functions of financial intermediation smoothly. The second feature of a stable financial system is its robustness to absorb internal and external shocks (Mare, 2015). Stress test is a key instrument used to assess the potential of the financial systems specially banks to absorb shocks of various intensity (Jobst, Ong, & Schmieder, 2013). Shocks are events having negative (or positive) clout on financial institutions smooth functioning. A positive shock is an event which transfers net worth form other sectors of economy to financial sector (Hirakata, Sudo, & Ueda, 2009). Hall (2017) terms a positive (negative) shock as an event

¹¹See banking reviews of Deutsche Bundesbank, Czech National Bank

¹²See financial stability review, Bank of Japan

which makes financial institutions intermediation more (less) efficient and less (more) costly. Nolan and Thoenissen (2009) also interpret the financial shock in terms of its impact on efficiency of contractual association between lenders and borrowers. According to them writing debt contract becomes more difficult after a financial shock and cost of intermediation increases. Meh and Moran (2010) defines the financial shock as an event or change occurring outside financial sector having an adverse bearing on banks net worth. In this study the shock mean a ‘financial shock’ having negative influence on financial sector.

Financial shock affects functioning, profitability and net assets in different ways. Macrofinancial route is the most important one through which the negative impact of shock is transferred to financial system. Financial shock adversely affect macroeconomic indicators like GDP growth, rate of employment of factors of production etc which further affect debt retiring capacity of individuals, firms and thus increasing non-performing loans of financial sector (Schmieder, Puhr & Hasan, 2011). When a loan advanced by a bank is classified as nonperforming, banks reevaluate it using various tools and assign it a new value, less than it original value. The loss in value is then deducted from assets as well as shareholders equity and balance sheet rewritten. When loss in value of nonperforming assets surpasses the value of shareholders’ equity, the bank becomes insolvent. This approach assessing stability of financial institutions through its NPL ratio is referred as ‘credit risk approach’¹³. Another route through which shock effects are conducted to financial system is change in market prices of financial assets. Changes in interest and exchange rates have a straight and direct effect on prices of bank debt instruments and market value of its business in foreign currency (Barnhill & Schumacher, 2011). Changes in financial institution assets have a direct bearing on its capital and thus financial stability. This process used for assessing stability of financial institutions by using variation in its assets values is termed as ‘market risk approach’ (Vinals, 2012). Shock can also stimulate contagion and bank run

¹³See Revisions to the Standardized Approach for credit risk Bank for International Settlement, 2014

situation creating liquidity issue and cash insolvency situation for financial institutions. The procedure evaluating banks for liquidity comes under liquidity risk approach.

Macrofinancial analysis and application of stress testing techniques have some significant issues. Stress testing and scenario analyzing require extensive and up to date data (Glasserman, Paul & Gowtham, 2015). But the data is not available to independent analysts and sometimes even to IMF staff (Borio, Drehmann, & Tsatsaronis, 2014). As per the agreement between IMF and member countries (Article VIII of the Articles of Agreement), member countries are not bound to provide data to IMF staff for stress testing (Jobst et al., 2013). Even if data is provided, IMF staff cannot share detail results of its analysis, unless written permission is obtained from concerned member country (Goldmann, 2013). Till 2012, only 45 percent of the total member countries had allowed IMF staff to publish complete details of the analysis (stress tests) of their respective financial systems (Smaga, 2013).

As supervisors of financial institutions, Central banks of all the countries also carry out detail analysis (stress test & scenario analyze) of all the financial institutions under its control¹⁴. However, in order to avoid creation of any false alarm, there is a tendency to hold detail of results, specially related to financially weak institutions (Smaga, 2013). On the negative side, this confidentiality on the part of supervisors creates a false sense of security, and discredits the reports made public by them (Vinals, 2012). Flexibility in selection of risks, and in choosing (defining) the scenarios (for stress testing) provides supervisors the opportunity to ‘improvise’ the results of their analysis (Alfaro & Drehmann, 2009). Macroprudential analysis including stress testing requires data that is not publicly available (Goldmann, 2013). Due to these constraints, the approach of macrofinancial analysis and stress testing is used by financial institutions and regulators only and are ‘out of bound’ for independent researchers and financial analysts (Jobst et al., 2013).

¹⁴See BCBS, Peer review of supervisory authorities’ implementation of stress testing principles, April 2012, 8

Independent analysts (analysts other than IMF and Central Banks' staff) therefore have another way to evaluate financial health of credit institutions. They use available data of macroeconomic indicators (Prasanna, 2014; Badar & Javid, 2013), industry specific variables (Siddiqui, Malik, & Shah, 2012) and bank level data (Hassan, Ilyas & Rehman, 2015; Hue, 2015; Masood & Aktan, 2009) and assess its influence on credit risk (NPL ratio etc) of financial institutions using statistical techniques (Chisti, 2012). The issue with such types of analysis is that this approach studies just one aspect of multifaceted problem (Barnhill & Schumacher, 2011). There is no work done on studying the credit loss in conjunction with banks robustness in the shape of its liquidity or equity used as buffer against shocks (Drehmann, Borio, Tsatsaronis, 2011).

1.1.1 Overview of the Indian Banking System

Financial sectors of South Asian economies are dominated by commercial banks. During 2014, Indian banking sector controlled more than 60% assets of the financial sector¹⁵. Indian banking sector is however, functioning in a volatile environment in terms of nonperforming assets. In Dec 2013, Reserve Bank of India released a discussion paper. Citing the slowdown in Indian economy, Reserve Bank of India remarked that certain Indian businesses were under financial distress and resultantly a surge had been observed in banks' nonperforming assets. Reserve Bank of India had therefore, asked to start an academic discussion as to how a financial distress of a company can be recognized well in time, what steps can then be taken to avoid financial distress, and if unavoidable then how can it be resolved promptly. Reserve Bank of India had maintained that the purpose of the discussion paper was to facilitate fair recovery of lenders money. Reserve Bank of India had also asserted that financially distressed assets not only produce less return but also cause quick deterioration in the value of financial assets¹⁶.

In its report¹⁷ on trends and progress of banking in India, Reserve Bank of India expressed concern over the continuous downward trend of banking sector specially

¹⁵RBI Financial system review, 2015

¹⁶RBI Press Release no : 2013-2014/1220 dated 17-12-2013

¹⁷RBI Report on trends and progress of banking in India 2014-15

banking sector during the period 2011-15. The report identifies and discusses three indicators for explaining the deterioration in banking sector of India. First, the slowdown in balance sheet growth since 2011 specially the bank credit. Second, the profitability of the banks especially public sector banks declined significantly during the period reviewed. Thirdly, the report states that nonperforming loans of all banks particularly public sector banks have shown a constant upward trend. In its half yearly Financial Stability Report for the period March-September, Reserve Bank of India painted an unpromising picture of the banking sector of India. The stability report states that as compared to period of last report (second half of financial year 2014-15), business of scheduled commercial banks has slowed down, NPL has increased, profitability of banks has declined and that the industry has recorded a 20% stressed advances. On the other side, the report says that capital to risk-weighted assets ratio of scheduled commercial banks have shown deterioration, with public sector banks recording lowest risk-weighted assets ratio¹⁸.

International Monetary Fund (IMF) assessed the financial sector of India for its stability condition. The assessment process was started in Jun 2011 and finalized in October 2011¹⁹. The findings of the assessment report were discussed with RBI authorities before finalization. The report maintains that India has taken significant steps to establish a stable financial system however; its financial sector was still facing vulnerabilities. The report asserts that asset quality of the banking system was deteriorating and pressure on systematic liquidity was increasing. The report finds out that Government's hold on banking system is tight, forcing the banks to tow its line in advancing the loans. This interference in banking system was thought to be creating a risk of misallocation of resources and reducing pace of economic activities. Another drawback of state control identified was mandatory holdings of government securities by banking institutions which reduced banks' capacity of advancing loans to private sector or investing its funds in other more profitable projects. The report suggested that regulatory authorities may be given greater *de jure* independence and central and state governments control on financial institutions diluted. It was also suggested that in order to

¹⁸See RBI Financial stability report, Dec 2015

¹⁹See IMF Country Report No. 13/8 Jan 2013

expand its operational capacity, banks may be allowed more access to domestic and foreign capital. The report pointed out a flaw in the structure and role of Reserve Bank of India. The bank's officers are nominated as directors of Board of public sector banks. Reserve Bank of India plays role as regulator of banking sector therefore its officers sitting on banks' boards were thought to create conflict of interest, affecting performance of Reserve Bank of India as regulator. Another shortcoming identified by IMF team in the Reserve Bank of India was its conflicting roles as regulator monitoring the performance of banks and government debt manager. As directed by government, Reserve Bank of India also directs banks to advance loans to priority sectors like agriculture, health, education etc. The report considers these roles as contradictory, as debt management can dilute its effectiveness as regulator and monitor. Although the business climate has exhibited moderate improvement since September 2014, the nonperforming assets of commercial banks especially public sector banks still have an upward trend²⁰. Profit margins of Indian corporate sector are shrinking, adversely affecting its debt repayment capacity. If business climate did not improve, non performing assets of banking sector may further aggrandize²¹.

1.1.2 Overview of the Pakistani Banking System

Pakistani banking sector has also not been comprehensively reviewed by regulators and independent researchers. Pakistan's banking sector has not been assessed by IMF in the recent past. As part of documentation and consultation with member countries under financial system stability assessment program (FSAP), the last assessment made by IMF team and World Bank was completed on 8 Jun 2004²². The information given in the report does not stand valid in 2015 after a time lag of eleven years. However, three findings of the team mentioned in their report are considered of interest for the readers and therefore reproduced. The report had appreciated the reforms made by regulatory authorities, which had made the financial system more resilient and shock absorbent. The team had also praised the

²⁰Reserve Bank of India Financial Stability Report, June 2015

²¹Reserve Bank of India press release, 1st half 2015

²²IMF Country Report No. 04/215, July 2004

privatization of state owned weak banks and termed the process as achievement of the last decade. The third finding of the report was on rapid increase in advances to private sector. The report had observed that credit expansion had taken place in the area where finance manager had little experience. The report had therefore shown concern and fear of increase in NPL ratio.

State Bank of Pakistan (SBP) as regulator of the banking system keeps on reviewing the banking system. The purpose of this practice is to improve transparency, by analyzing performance of financial institutions as well financial system. Banking System Review (BSR), financial statement analysis of the financial sector and financial stability reviews (FSR) are three approaches adopted by SBP to analyze the performance, resilience against shocks and risks faced by financial institution. However, as a regulator and a custodian of the stability of financial sector it cannot publicly disclose 'market sensitive information' like fragility of financial health of a bank. Although it cannot completely withhold such information, therefore they disclose the findings in an ambiguous manner. Last stability assessment report issued by State Bank of Pakistan (SBP) is 'Financial Statements Analysis of the Financial Sector' for the period 2009-13²³. As evident from its title, the analysis is based on the annual financial statements of the banks for the years reviewed. In this paragraph we dilate upon the trend of values given in the SBP Financial Statements analysis of financial sector for the years 2011-15²⁴. The profitability and efficiency of the banking system which is a favorite proxy for stability of banking system, has been scrutinized by various ratios. Net interest margin (net interest income/total assets) of overall banking system has exhibited a constant downswing from 4.16% during 2011 to 3.47% during 2012 and 3.32% during 2013. As per above mentioned assessment report, Net interest margin (NIM) of public sector banks was 3.29% in 2011, declined sharply to 2.82% in 2012 and 2.56% in 2013. Return on assets (ROA) which is another popular ratio for gauging efficiency/profitability, has also shown sharp decline from 2011 to 2013. For overall banking sector, ROA was 1.39% during 2011, declined sharply to 1.22% during

²³SBP Financial statements analysis of financial sector 2009-13

²⁴SBP Financial statements analysis of financial sector 2011-15

2112 and 1.08% during 2013. For public sector banks ROE has displayed an obvious drop from 1.27% in 2011, to 1.05% in 2112 and 0.46% in 2013. Ratio of administrative expenses to profit before tax has shown an upward swing from 1.33 in 2011, 1.42 in 2112 and 1.65 in 2013 for overall banking sector. For public sector banks Ratio of administrative expenses to profit before tax has shown a remarkable surge from 1.27 in 2011, to 1.65 in 2112 and 3.84 in 2013. Data of earnings per share (EPS) for overall banking sector is not available. For local banks EPS has demonstrated an explicit fall from Rupees 2.71 during 2011 to Rupees 0.06 during 2012 and Rupees 0.05 during 2013. For public sector banks the downturn is more conspicuous. It was Rupees 4.81 during 2011, declined to Rupees 0.01 during 2012 and Rupees 0.00 during 2013. Liquidity ratio is another well known measure of the financial stability of banking system and has been analyzed with the help of cash & cash equivalent to total assets, gross advances to borrowing & deposit etc. Liquidity is a bank's ability to meet its obligations as they come due, without incurring undue losses by selling its illiquid assets at discount. High value of this ratio means that the bank is in possession of more liquid assets²⁵. The first liquidity ratio, cash & cash equivalent to total assets for overall banking sector has also displayed a decline from 10.76% in 2011, declined sharply to 10.69% in 2112 and 10.13% in 2013. As far as public sector banks are concerned, cash & cash equivalent to total assets ratio has shown a decline from 11.99% in 2011, to 11.89% in 2012 and 11.31% in 2013. Ratio of gross advances to borrowing & deposit is another measure utilized to adjudge liquidity and risk assumption of bank. For overall banking sectors this value has displayed a constant decline during the period 2011-2013. Ratio of gross advances to borrowing & deposit was 54.76% in 2011, declined sharply to 50.96% in 2012 and 50.53% in 2013. Capital leverage ratio is another ratio another popular measure of a banks robustness to meet its obligation and absorb any endogenous and exogenous shocks. Capital ratio (equity/assets) was 9.29% in 2011, declined to 8.40% in 2012 and 8.22% in 2013. For local commercial banks the ratio was 9.05% in 2011, declined to 8.19% in 2012 and 8.05% in 2013. All the indicators described in the preceding paragraph

²⁵See Basel Committee on Banking Supervision. 2008a

are taken from the analysis report of financial statements of bank made by SBP. The indicator discussed above paints an unpromising picture of Pakistani banking sector. Latest review of banking system has been released in 2006²⁶. The information given in the review is therefore not relevant for this study due to time lag of ten years. After 2006, this review has been discontinued. The financial system is reviewed by its financial statement analysis and 6-monthly financial stability review.

Financial statement analysis published by Central Banks provides ample information about balance sheets, profit and loss account, statement of change in equity and cash flow statements of the commercial banks. However, the influence of macroeconomic conditions, (along with industry and bank level factors) on asset quality of banks is also well documented in literature. Objective of this study is to develop a model of stress testing for identification of threats to stability of banks and overall banking systems.

1.2 Statement of the Problem

Financial systems of various economies of the world have experienced financial crises impairing its financial and real economies and resultant agonies in the shape of bankruptcy, unemployment, debt, poverty and sharp decline in productivity. Developed economies have the resilience to withstand such crises and reinvigorate its financial institutions by providing bailout packages (Saunders & Allen, 2010). Developing economies like Pakistan and India do not possess such potential and therefore have the only option to avoid such situations by continual in-depth investigation and keep the system on track through preemptive, preventive and corrective actions. Unfortunately, stability of financial sectors of Pakistan and India has not been investigated by independent researchers for its capacity to withstand shocks (Glasserman, Paul & Gowtham, 2015). Studies made so far have restricted its scope to some specific group of factors affecting financial strength (represented by NPL ratio) of some specific types of banks.

²⁶SBP Banking System Review, 2006

Banking sectors of Pakistan and India are functioning in a comparatively difficult business environment. Cost of doing business is very high in both these countries. Interest rate spread, overall interest rates and corporate tax rates are higher as compared to other economies. Political interference is common. Banks are compelled to advance loans on low interest rates and minimum collateral/security to specific sectors and firms. Adverse impact of all these factors on financial stability of banks is well documented in literature. Banking sectors of Pakistan and India, therefore, warrant special investigation for its capacity to defy any unfavorable economic conditions.

1.3 Research Questions

Research questions of the study are as under:

1. Which macroeconomic, bank specific and industry specific indicators have significant influence on nonperforming loans (NPL) ratio of commercial banks of Pakistan and India?
2. Which commercial banks of Pakistan and India were unstable during sample period in terms of its estimated NPL/advance surpassing its equity/advance?
3. Whether banking systems of India and Pakistan remained unstable, less stable or stable during sample period.
4. Whether banking system of India and Pakistan would have remained unstable, less stable or stable during sample period (yearly basis), in any given scenario developed on the basis of extreme values of macroeconomic indicators during sample period. Average and worst values of macroeconomic indicators (MEI) and industry specific indicators (ISI) during sample period are used for normal (scenario 1) and worst (scenario 3) economic conditions respectively. For bad economic conditions (scenario 2) mean values of average (scenario 1) and worst values (scenario 3) were used.

1.4 Objectives of the Study

The study has the following objectives:

1. To identify the determinants of nonperforming loans of Pakistani and Indian commercial banks.
2. To provide insight about the stability of banking systems of Pakistan and India.
3. To assess the stability of banking systems of Pakistan and India in good, bad and worst economic conditions.

1.5 Significance of the Study

Financial system crises in the recent past and its devastating effect have acted as eye opener for financial system regulators and financial managers of all economies. Developed economies possess the resilience to withstand the adverse effect of disruption of financial systems and to bring it back on track (Saunders & Allen, 2010). Developing economies however, lack such capability and has to focus on detecting any weakness well in time and take preventive and corrective measures. International Monetary Fund and World Bank have developed some sophisticated techniques like stress testing, scenario analysis etc for assessing the stability of financial systems of member countries under its Financial System Assessment Programme (FSAP). Financial System regulators especially the central banks also keep on monitoring its respective financial systems. Unfortunately, Pakistan's financial system has not been evaluated by International Monetary Fund during the last twelve years²⁷. IMF has selected only 29 countries (having systematically important financial sectors) for mandatory assessment. Pakistan is not included in that list²⁸. Indian financial system has also not been scrutinized by International Monetary Fund after 2011²⁹. The fund had shared its findings with RBI

²⁷IMF Country Report No. 04/215, July 2004

²⁸IMF mandatory financial system assessment program
<https://www.imf.org/external/np/fsap/mandatoryfsap.htm>

²⁹See IMF Country Report No. 13/8 Jan 2013

authorities and had expressed concern over deteriorating state of nonperforming loans and declining equity positions of Indian scheduled commercial banks. State Bank of Pakistan has assessed the financial institution of Pakistan by reviewing its financial statement for the year 2013³⁰. Reserve Bank of India has evaluated its financial institutions in 2013³¹ and has expressed concern over negative trends in its asset quality and declining profit margins.

Literature Review suggests that studies carried out so far have restricted its' scope to the influence of macroeconomic and/or industry and/or bank specific factors of individual banks/group of banks on its non-performing loans. Less work has been conducted to see non-performing loans vis-a-vis equity of banks and banking system. Similarly resilience of banks and banking system against shocks (bad, worst economic conditions) has not been analyzed for Pakistani / Indian banking sectors. International Monetary Fund and respective central banks have reviewed the potential of both these banking systems to absorb shocks. They have, however not made their finding about fragile banks public, considering it as market sensitive.

This study is an attempt to explore all types of factors affecting asset quality of the whole banking sectors of Pakistan and India and compare the estimated nonperforming loans of financial institutions with its equity, and thus evaluating its state of solvency. The study also stress tests all sample commercial banks for its robustness to withstand macroeconomic shock during different scenarios. This study is going to develop an empirical model which will equip the regulators and banks' management in Pakistan and India to estimate its non-performing assets ratio in advance i.e. at the start of accounting year, for a given set of values of bank specific factors (BSF), industry specific indicator (ISI) and macroeconomic indicators (MEI) identified by the study. The regulators are in control of the values of ISI and BSF (and not of MEI) and can therefore manage the values of ISI and BSF in advance to avert any undesired situation. The model will equip other stakeholders with a tool to evaluate financial health of any bank in advance. This study is expected to open a new area for research and stimulate a series of studies

³⁰See SBP Financial Statements Analysis-2013

³¹See Reserve Bank of India Financial Stability Review-2013

on the subject. It will also help in identifying weak areas and links of financial systems, prompting the financial sectors' regulators and financial managers to take necessary preventive and corrective measures to ensure avoidance of financial systems' failure.

To summarize, this study contributes to the existing knowledge in a number of ways. This study is the first attempt estimating the 'state of solvency' of commercial banks and overall banking sectors of Pakistan and India. Secondly, this study is the first of its kind by independent analysts, assessing the robustness of commercial banks and overall banking sectors of Pakistan and India to withstand macroeconomic shocks of different intensity. Third, it is the first attempt by independent researchers to develop a framework (empirical model) for assessing financial strength of a bank (and banking sector) in advance i.e. at the start of financial year, for a given set of values of bank level, industry level and macroeconomic indicators. Fourth, this study is an attempt to 'ship in uncharted waters', and is opening a new area for analysis by independent analysts.

1.6 Plan of the Study

The study is designed as following. Theoretical foundation and empirical results are scrutinized in the first two chapters i.e. 'introduction' and 'literature review'. Research design, data set used, various steps of research, variables studied and scope of research have been discussed in the 'data description and research methodology' chapter. Results of diagnostic tests and empirical analysis of the data are given in chapter four of the study. Chapter five dilates upon the results of the study and recommendations of the study separately for Pakistan and India.

1.7 Limitation of the Study

Pakistan and India have not experienced financial crisis due to some shock/contagion, therefore shock events and its influence on economic indicators are not included in the design of the stress testing.

Past studies do not provide any insight for terming a bank stable or unstable on the basis of NPL versus equity ratio. There is no widely agreed upon definition of stability of financial system (Smaga, 2013). Past studies therefore, do not provide any guidance for terming a financial system unstable or stable on the basis unstable banks as percent of all banks. Operational definitions were therefore introduced for this study.

Chapter 2

Review of Related Literature

In this chapter, literature related to analyses of the banking systems especially of Pakistan and India, and the methodology used by IMF and Central Banks for evaluation of financial systems is reviewed.

2.1 Review of Methodology

During the last fifteen years, studies assessing stability of financial sectors and individual financial institutions have gained momentum (Barnhill & Schumacher, 2011). Reasons for this enhanced interest can be attributed to a number of crises, impairing financial sectors of various economies. Financial sectors of Pakistan and India have not been comprehensively analyzed by regulators as well as independent researchers. As part of its Financial System Assessment Program (FSAF), IMF has evaluated financial system of Pakistan in 2004 only¹. The findings given in the report does not stand valid in 2016 after a time lag of eleven years. Last stability assessment report² issued by State Bank of Pakistan (SBP) is ‘Financial Statement Analysis of the Financial Sector’ for the period 2009-13 (FSA 2009-13). As evident from its title, the analysis is based on the annual financial statements of the banks for the years reviewed. Perusal of the same FSA discerns that profitability ratios i.e. net interest margin, return on assets and return on equity of

¹IMF Country Report No. 04/215, July 2004

²See Financial Statement Analysis of the Financial Sector’ for the period 2009-13

Pakistani banking sector have exhibited a constant down ward trend since 2011. NPL ratios of a number of banks like Bank of Punjab, KASB bank have also shown an upward trend during the period. International Monetary Fund (IMF) assessed the financial sector of India for its stability condition in 2011. In its analysis report, the IMF authorities have pointed out a number of weak areas in Indian financial system. The report has maintained that asset quality and liquidity position of Indian banking system is showing constant deterioration. As per Financial Stability Report (FSR) released by Reserve Bank of India in June 2015³, the non-performing assets of commercial banks especially public sector banks have exhibited an upward trend and profit margins of corporate sector are declining, adversely affecting its debt repayment capacity. IMF and central banks do scrutinize the financial strength of all credit institutions. The weak links detected are however communicated only to respective banks' top management with necessary advice and not made public (Jobst et al., 2013). This information is market sensitive not only for the concerned institution but financial system. Withholding such negative information however makes the credibility of such reports questionable (Smaga, 2013).

Independent analysts (analysts other than IMF and Central Banks' staff) have not analyzed the financial sectors of Pakistan and India comprehensively. Studies made so far have restricted its scope to some specific group of factors affecting asset quality (represented by NPL ratio) of some specific types of banks. Assessing NPL ratio for influence of other factors is tantamount to examine one side of the picture. Like any other business, a financial institution remains solvent and stable till the time it has positive value of shareholders' equity. Shareholder's equity has a vital function to act as buffer against endogenous and exogenous shocks (Drehmann et al., 2011). Studies which have reviewed stability of financial sectors of Pakistan and India so far have overlooked this function of shareholders' equity. Robustness of the financial systems to withstand shocks has not been reviewed by independent researchers. The state of banking systems of both Pakistan and India is not certain and warrants a thorough scrutiny by some independent analysts.

³Reserve Bank of India, Financial Stability Report, 2015

The aim of this study is not only to scrutinize all types of factors influencing NPL ratio of financial institutions but to compare the estimated NPL ratios with equity position of respective banks. The output of the process shall then be used to evaluate resilience of the financial institutions and financial sectors under different macroeconomic scenarios developed on the basis of extreme values of macroeconomic indicators during sample period (Schmieder et al., 2011).

2.2 Stress Testing Approaches

Stress test is not some simple mathematical formula or statistical tool. It has a flexible frame work equipped with a wide variety of analytical models (Galati & Moessner, 2013). Taking a little risk of oversimplification, these models can be divided into two broad approaches. The models carrying out detailed review of individual institutions' balance sheets are referred as 'balance sheet-based approaches' or 'fundamental approaches' (Foglia, 2009). Models taking account of the market value of an individual portfolio, institution or whole financial system on the basis of stock, bond and derivatives are termed as 'market price based approaches' (Barnhill & Schumacher, 2011). Both these approaches have strong and weak areas in its application (Borio et al., 2014). However, these approaches should not be taken as perfect substitutes of each other. The fundamental or balance sheet based approaches focus on individual bank's portfolios, analyze its on- and off-balance sheet positions and identify the risks to which each portfolio is exposed (Foglia, 2009). These approaches are more informative and suitable for applying to emerging economies where bond, stock, derivatives and other over the counter markets are less developed and financial systems are dominated by commercial banks (Goldmann, 2013). Simple balance sheet-based models with single or multi-factor shocks are applicable with ease in countries having only basic supervisory data (Čihák, 2007). However, these models are backward looking as balance sheet data is released after a typical lag of time. In Pakistan and India for example the data is made public after a lapse of 15 months. Other weak areas of balance sheet - based models are its data intensive nature, are difficult to update

and unable to capture ‘contagion’ among institutions and portfolios (Borio et al., 2014). Analysts have developed new models to assess all risks in an integrated manner (Barnhill and Schumacher, 2011) but are still data-intensive and needs further refinement. Market price-based models, on the other hand, are flexible, can be updated as and when required (Avesani, Liu, Mirestean & Salvati, 2006) and suitable for capturing contagion effect (Gray & Malone, 2008). However, these models capture a wide variety of risks and it is difficult to disentangle the risks and estimate influence of each risk separately. Another drawback of market price based models is its sensitivity to frequent swings in perception about market (Borio et al., 2014). Such short term changes in perception have very little linkages with market fundamentals but have material effect on output estimated by models. These models are dependent on market value of financial instruments and therefore, not suitable for low income and emerging economies with weak regulatory regime and limited availability of data due to weak accounting systems (Greenlaw, Kashyap, Schoenholtz & Shin, 2012). Both types of models i.e. balance sheet as well as market based face a common challenge of finding a way to stress test a single institution to system level risk (Vinals, 2012).

2.2.1 Process of Stress Testing-Framework

A typical stress testing is a multistage process (Jones, Hilbers & Slack, 2004; Čihák, 2007). As a first step, possible stress events are identified in the environment. The nature as well as clout of stressors is different in different economies (Goldmann, 2013). For example sudden significant oil price hike in international market has positive influence on economic indicators of oil exporting countries but negative on those of oil importing economies. In second step, empirical model is developed for estimating the sway of level of stress events (shocks) on macroeconomic indicators like GDP growth, interest rate, exchange rate etc (Vinals, 2012). In step three, a ‘satellite model’ is developed to link the changes in macroeconomic variables in each scenario (of shock situation) with asset quality of the financial institutions and expected credit losses estimated (Galati, & Moessner, 2013). The impact of shocks on banks’ asset quality is conducted via credit risk as well as

market risk. Credit risk means influence of adverse movement in economic indicators on non performing loans of the financial institutions (Mare, 2015), while market risk refers to downward swing in asset prices of loan portfolio i.e. bonds, investment in foreign currencies (Jobst et al., 2013). The estimated losses for each shock situation are then compared to profit and capital used as buffer against shock and thus stability of the financial institution/system ascertained under the influence of various shocks (Drehmann et al., 2011).

A financial system is said to be stable if it is capable of facilitating smooth flow of funds for economic activities of a country and is able to dissipate disturbances arising endogenously or caused by some exogenous adverse events (Barnhill & Schumacher, 2011). On the other hand, financial instability means disruption in flow of funds for investment⁴. History is however, full of incidences of financial crises disrupting the normal functions of financial systems. Global financial crisis 2007-08 is considered to be the worst crisis after 1930 great depression (Reinhart & Rogoff, 2013). Global financial crisis 2007-08 was triggered by subprime loans (Demyanyk & Van Hemert, 2009; Saunders & Allen, 2010; Shiller, 2012) for houses and housing price bubble in United States (Eichengreen, Mody, Nedeljkovic & Sarno, 2012).

The crisis gradually took almost all European economies in its grip causing failure of key businesses, resulting in trillions of dollars reduction in consumers' wealth, and slowdown of economy leading to the 2008-12 global recession (Dinos & Ashta, 2010). The crisis is also considered to have sown the seed of the European Sovereign debt crisis (Reinhart & Rogoff, 2013). Financial crises have acted a wakeup call for economic and financial managers at all level. International financial institutions like IMF, World Bank and Bank for International Settlement have initiated a number of programs for surveillance, monitoring and guidance of financial regulators of member countries (Glasserman, Paul & Gowtham, 2015). Central banks have also devised techniques to regulate activities of financial institutions and provide them guidance and support for their smooth functioning

⁴World Bank Financial Stability Report, 2013

(Ingves, 2011). Macro-prudential analysis, stress testing, scenario analysis, sensitivity analysis etc are various tools introduced by financial regulators (Schmieder et al., 2011). The purpose of using these tools and techniques is to identify weak links in the financial institutions and financial sector well in time and then take preventive and corrective measure with a view to avoid full blown financial crises. All these financial regulators, international as well as national share its findings about any financial system and financial institutions with concerned regulators (of respective financial system) and top management of respective financial institutions. The weaknesses identified are however, never made public (Jobst et al., 2013). The adverse findings are withheld because such information is market sensitive for the concerned financial system and financial institutions. Making such information public is feared to not only jeopardize the financial strength of the concerned financial institutions and financial system but also of other inter-linked financial entities due to contagion (Greenlaw, Kashyap, Schoenholtz & Shin, 2012). Another reason for withholding such findings is its confidential nature as the regulators reach such conclusions with the help of data provided by concerned financial entities under mutually agreed disclosure clauses (Jobst et al., 2013).

2.2.1.1 Stress Test at Portfolio Level-Steps in Selecting a Model

Specification of a stress test involves a number of decisions. The first step is to decide the type of risk model to be employed. The decision is made by selecting type of risk(s) to be studied (Galati & Moessner, 2013). The list of risks include market risk (interest and exchange rate risks influencing price of assets of financial institutions), credit risk (GDP growth, unemployment etc having clout on asset quality ratio) and others like liquidity, operational etc for sway on solvency (Simons & Rolwes, 2009). The next step is deciding the type of stress test. Type of stress test include sensitivity analysis (varying the value of a single factor for assessing its influence on asset quality), scenario analysis (varying the value of multiple factors for assessing its influence on asset quality), and others (Alfaro & Drehman, 2009). The next decision to make is selection of shock. The shock may be individual market variable (price of asset, interest rate etc), underlying volatility (affecting

the price of option etc), underlying correlation (Barnhill & Schumacher, 2011). The last decision to make is choosing type of scenario. The type of scenario is selected on the basis of historical values (past value of stress factor), hypothetical values (a plausible value of stressor) or developed through Monte Carlo simulation (Galati & Moessner, 2013). Historical values based scenario is the most popular and intuitive approach, because such event has actually happened in the past and can recur in future (Jobst et al., 2013).

Stress test at portfolio level discussed in the preceding paragraph is carried out by individual banks using up-to-date data available in bank and to some extent to regulatory supervisor as regulatory disclosure (Vinals, 2012). The results of the tests are used by bank management for decision making about refinement of operations and also shared with regulator but not made public (Goldmann, 2013).

2.2.1.2 Aggregate Stress Testing of Financial Systems

Aggregate stress test assesses the risk exposure of group of financial institutions to a predefined stress scenario. The purpose of aggregate stress is to help central banks and financial regulators detect vulnerabilities in the financial system that can cause disruption in financial intermediation process (Foglia, 2009). The aggregate stress testing methodology is not an easy one and poses a number of challenges for the analysts (Goldmann, 2013). The first challenge is deciding the scope of the stress test. For example financial institutions having diverse portfolios and having complex claims against each other are difficult to be studied by single model (Barnhill & Schumacher, 2011). Another issue is the complex composition of financial system such as banking and non banking financial institutions (Greenlaw, Kashyap, Schoenholtz & Shin, 2012). Selection of major player e.g. banking system for study can be problematic if nonbank financial institutions are also a source of significant threat to the process of intermediation (Shiller, 2012). In case of India and Pakistan, nonbank financial institutions are less developed. They form a very small part of the whole financial system and can therefore be excluded from analysis. Another issue of aggregate stress testing is the presence of subsidiaries of foreign banks (Rodolfo & Kalin, 2012). The stability of its parent

banks are a source of strength to the subsidiary and domestic financial system. However, the collapse of parent bank creates difficulties in the payment and settlement system for its subsidiary which can affect domestic financial system through contagion (Barnhill & Schumacher, 2011). In short the significant presence of foreign banks in a financial system is source of stability as well shocks, depending upon financial health of its parent banks (Rodolfo & Kalin, 2012). Keeping these linkages in mind, foreign banks may be excluded from the sample banks, only if there is strong evidence that the foreign banks are not a source of significant risk to the domestic financial system (Hirakata et al., 2017). In Pakistan and India foreign banks form a significant portion of its financial systems and therefore require to be considered for analysis.

Process of aggregation is another methodological issue presented in the aggregate stress testing. Results of stress testing can be obtained either by aggregating the results of individual portfolios or by testing to aggregated portfolio (Greenlaw, Kashyap, Schoenholtz & Shin, 2012). In countries where uniform and precise stress techniques are used, the results of stress tests conducted by individual banks can be aggregated (Goldmann, 2013). In Pakistan and India data regarding portfolios held by banks is not available, therefore, in this paper we are not considering stress testing of portfolios.

Independent analysts have restricted their analysis mainly to the determinants of asset quality of financial entities of various economies especially those suffered from financial crisis of some nature. Financial sectors of Pakistan and India are in the list of those which have not been comprehensively analyzed by independent researchers. Studies made so far have restricted its scope to some specific group of factors affecting asset quality (represented by NPL ratio) of some specific types of banks (Ahmad & Bashir, 2013). Assessing non-performing loans ratio for influence of other factors is tantamount to examine only one aspect of the problem. Like any other business, a financial institution remains solvent and stable till the time it has positive value of shareholders' equity. Shareholder's equity has a vital function to act as buffer against endogenous and exogenous shocks (Drehmann et al., 2011).

Studies which have reviewed stability of financial sectors of Pakistan and India have so far disregarded this function of shareholders' equity.

Studies assessing stability of financial systems and individual credit institutions can be divided into two groups, i.e. studies made by International Monetary Fund (IMF) and respective central banks as regulators (Greenlaw et al., 2012), and studies conducted by independent researchers.

IMF and World Bank have initiated a program by the name Financial Systems Assessment Program (FSAP) with an object to identify weak areas in the financial systems of member countries and provide technical advice for preventive and corrective actions. Financial system of Pakistan⁵ and India⁶ were assessed during 2004 and 2011 respectively. Resilience of financial systems to withstand shocks is a key component of FSAP and stress testing is a main tool (Foglia, 2009) utilized to assess the existence and extent of resilience of a financial system. The term stress test denotes a range of analytical techniques used to evaluate the exposure of portfolio to risk arising from changes in macroeconomic condition, or to some unexpected but plausible event (Jobst et al., 2013).

A typical stress testing is a multistage process (Jones, Hilbers, and Slack, 2004 and Čihák, 2007). As a first step, stressors also called 'stress events' are identified in the environment. Then the influence of stress events on macroeconomic indicators is measured using some econometric, vector autoregressive or pure statistical approach and the values of macroeconomic indicators like GDP growth, interest rate, exchange rate etc estimated (Borio et al., 2014). Regulators enjoy the liberty to choose any model⁷. In step three, a 'satellite model' is developed to link the changes in macroeconomic variables in each scenario (of shock situation) with asset quality of the financial institutions and expected credit losses estimated (Vinals, 2012). The impact of shocks on banks asset quality is via credit risk as well as market risk (Stein, 2012). Credit risk means influence of adverse movement in economic indicators on non performing loans of the financial institutions, while market risk refers to downward swing in asset prices of loan portfolio i.e. bonds,

⁵IMF Country Report No. 04/215, July 2004

⁶See IMF Country Report No. 13/8 Jan 2013

⁷See Bank of Japan Financial Stability Review 2007

investment in foreign currencies etc (Jobst et al., 2013). The estimated losses for each shock situation are then compared to profit and/or capital used as buffer against shock and thus stability of the financial institution/system ascertained under the influence of various shocks (Drehmann et al., 2011). Stress test is not some simple mathematical formula or statistical tool. It has a flexible frame work equipped with a wide variety of analytical models.

2.3 Stability Assessment by Independent Researchers

Unfortunately, the process of stress testing is avoided by independent research analysts due to a number of practical issues present in it. Stress testing of credit risk is requirement of Bank of International Settlement (BIS) as Basel II Framework⁸, which entails incorporating various recession scenarios of trade cycle as well as other macroeconomic background of stressors. Incorporating these factors in the test makes it cumbersome and challenging not even for individual banks but also for independent analysts (Glasserman et al., 2015). Vibrant industry practices have not been established in the area of stress testing; therefore translating stress events into movement in bank micro variable via macroeconomic variables is a daunting task even for bank management (Goldmann, 2013). Independent researchers (analysts other than IMF, World Bank and central banks staff) have no access to data required for estimating market risk as banks do not share information about its investment in such portfolio. Banks calculate loss given default (LGD) about a particular borrower (individual or firm) by multiplying probability of default (PD) with exposure at default (Jobst et al., 2013). Any analyst other than bank itself may estimate probability of default (PD) of a certain type of loan by using influence of stress event through macroeconomic indicators (Borio et al., 2014). Data of exposure at default is however, not available to independent analysts, therefore unable to calculate loss given default. Central bank as regulator has access to banks data as per its disclosure requirement and on the basis of its

⁸See Basel Committee on Banking Supervision, 2005

demand for cash. This information is market sensitive and therefore central banks also do not make such information public.

Owing to the constraints discussed in the preceding paragraph, independent research analysts (analysts other than IMF, World Bank Researchers and Central Banks' staff) have evolved their own strategies to analyze the stability of individual financial institutions and overall financial systems. Their focus is on factors directly influencing non-performing loans of financial institution especially of banks. Broadly speaking, all the studies made by independent analysts can be grouped into four categories.

2.3.1 Macroeconomic Indicators and NPL Ratio

The first category of studies has concentrated on macroeconomic indicators (MEIs). Using ordinary least square, Hussain, Khalil, and Nawaz (2013) explored five macroeconomic variables i.e. exchange rate, energy, GDP growth, interest rate and share price index, for its influence on NPL ratio of commercial banks of Pakistan. The study employed time series data for the period 1990-2013, concluded that exchange rate, and energy have positive while GDP growth have negative clout on NPL of Pakistani banks. Interest rate and share price index were found to have no significant link with NPL. NPL itself was found to have a robust positive lagged effect on itself. Depreciation of home currency (exchange rate) on one hand, increases the prices of imported goods, causing inflation (and lowering income) and on the other hand, enhances bill for imported goods, resulting in enhanced burden to finance the letter of credits (LCs) already issued to importers by commercial banks, and therefore risk of default increases. Bertay, Demirgü-Kunt and Huizinga (2015) studied the relation between lending of banks and business cycle. Results of the study suggest that NPL of public banks increases during expansion phase and inflation (GDP deflator) has a positive influence on NPL of public banks. Employing quarterly data for the period Jan 2002-December 2011, Badar and Javid (2013) evaluated studied five macroeconomic factors for its relationship with NPL of Pakistani banks. Results of Johansen and Juselius multivariate co-integration test suggest that money supply and interest rate have

long term relation with NPL of Pakistani banks. Vector error correction model detected that inflation and exchange rates have a weak short term relationship with NPL of Pakistani commercial banks. Farhan, Sattar, Chaudhry, and Khalil (2012) carried out perception analysis about the influence of five macroeconomic variables for its impact on NPL of Pakistani commercial banks. The study concluded that energy crisis, lending rates, unemployment and inflation are perceived to have positive while GDP growth was thought to have negative influence on NPL of banks. GDP growth is indicative of enhanced economic activity by employing an increased quantity and more efficient use of factors of production. Resultantly, the factors of production get higher reward and thus increase in income. Increased income enables people to meet their financial obligations as per schedule thus depleting the quantity of NPL of commercial banks. Prasanna (2014) appraised NPL ratio of Indian banking sector for influence of macroeconomic indicators over it. Analyzing the data of 31 Indian commercial banks for the period 2000-2012, the study reveals that GDP and savings growth rates have negative while inflation and interest rates have positive bearing on NPL ratio of Indian banks. An overview of literature on the subject suggests that interest rate is positively correlated to NPL ratios as higher interest rates enhances cost of doing business and thus increase price level. Resultantly producers and consumers debt returning capabilities are adversely affected. Berge and Boye (2007) explored Nordic banking system over the period 1993-2005, to probe macroeconomic indicators for its clout on NPL. They found real interest rate, prices of houses and rate of unemployment responsible for having augmenting effect on problem loans. An increment in the unemployment in an economy has adverse effect on the incomes and debt retiring abilities of the individuals. From producers' point of view, high unmpR means low income of individuals thus lowering demand for goods and services, resulting in depleting sale/revenue of firms. Investors/producers' debt retiring ability is adversely affected and NPL of commercial banks increased. Boss, Fenz, Pann, Puh, Schneider & Ubl (2009) examined the association between business cycle (macroeconomic indicators) with problem loans and found GDP growth having an inverse clout on NPL. De Bock and Demyanets (2012) used annual data of 25 emerging

markets from 1996 to 2010 and investigated the determinants of banks bad asset in emerging markets. The study concluded that unfavorable terms of trade and limited export were positively related to problem loans of commercial banks operating in emerging economies. Lower GDP growth, exchange rate depreciation, a fall in debt-creating capital inflows and reduction in credit growth were other factors identified for deteriorating loan quality of these banks. Caporale, Colli, and Lopez, (2013) evaluated the bad loans ratio of the Italian banking system using monthly data for the period June 1998-June 2012. It was a three steps study, starting by recognizing the macroeconomic indicators of bad loans and gross loans, then assessing the amassment of bad loans during the period of recession and finally scrutinizing the impact of excess loan on bad loans. The study confirmed the pro-cyclical nature of bank loan which means that during boom loans increases and bad loans decreases and during recession it is other way round. The results of the study also connotes that credit expansion during recovery phases of business cycle are more incremental in NPLs as compared to contraction phase. Another conclusion of the study was that the influence of variation in loans advances during expansionary phase of a trade cycle on bad loans is significant for loans to firms, and not for loans to households. Jakubik and Reininger (2013) scrutinized factors affecting NPL ratio in banking systems of Central, Eastern and Southeastern European (CESEE) countries. As expected, results of the study confirmed that economic activity (GDP growth) increases income, enabling the borrowers to meet their debt obligations. GDP growth was therefore found to have negative bearing on NPL ratios. Stock index was also identified as a significant factor for negatively influencing NPL ratios. However the effect is observed with time lag and not contemporaneously. Exchange rate was another variable recognized by the study for having significant clout on NPL ratio. Depreciation of home currency in terms of foreign currency was found to have a negative effect on NPL ratio. However, the extent of the influence was found to be dependent upon the share of foreign currency loan in overall loan. Ahmad and Bashir (2013) explored the explanatory power of macroeconomic variables as determinants of non-performing loans in Pakistani banking sector. The study used annual time series data of NPL

ratio and probed nine macroeconomic variables over the period 1990-2011. In unison with the results of other studies on the subject, economic activity (GDP growth), industrial production and exports were found to have a robust negative impact while consumer price index was found to have strong positive association with NPL in Pakistani banking sector. As against findings of other studies, interest and inflation rates were found to have negative bearing on NPL in Pakistan. Inverse relationship between inflation rate and NPL in Pakistan becomes more inconceivable when seen in conjunction with positive influence of consumer price index on non performing assets, found in the same study. The study concluded that unemployment rate, real effective exchange rate and foreign direct investment had no bearing on NPL in Pakistan. Cifter, Yilmazer and Cifter (2009) scrutinized the industrial production for its efficacy to affect sector wise credit defaults cycle (NPL ratio) in Turkey for the period January 2001-November 2007. Results of their empirical analysis indicate that in Turkey cycles of industrial production do not influence the sector wise credit default cycles at the same time scales. They therefore suggested that to minimize credit default ratio, the creditors should benefit from the use of the multi-scale sector wise cycles. Nkusu (2011) investigated the interdependence of non-performing loans (NPL) and macroeconomic performance. Utilizing two complementary approaches first he empirically determined the macroeconomic determinants of NPL ratio then probed the effect of NPL ratio on macroeconomic determinants. The study concluded that since an increase in NPL ratio and poor economic performance are complementary, therefore the process of their effect on each other may be triggered by any one which shall be long lasting. The findings also throw light on the time lag effect of NPL ratio on itself. Abadi, Achsani and Rachmina (2014) explored six macroeconomic indicators for its potential reign on NPL ratio of Indonesian banking sector both at aggregate loans level and sector wise loans. The study applied vector error correction model and impulse response function to examine short as well as long term behaviour of NPL ratios in response to the chosen macroeconomic indicators. Interest rate was found to be the dominant variable affecting NPL of various sectors positively although having different leveraging power. Broad money M2 was also noticed for

positive power on NPL ratio. Inflation and exchange rates were identified for its diverse impact i.e. positive influence on NPL ratio of some sector and negative for others. Variation in import was observed to help restricting NPL ratio while bearing of industrial production was appraised insignificant. Study of macroeconomic indicators for its influence on the asset quality of banks is equivalent to reviewing a small part of the issue. Macroeconomic indicators are not the only factors influencing non-performing assets of financial institutions. Besides, credit losses alone do not explain the financial stability of a bank. A bank assuming more risk may be earning more profit (net interest) and higher NPL ratio. These studies also ignore the role of capital as buffer against credit losses and shocks (Drehmann et al., 2011).

2.3.2 Bank Specific Factors (BSF) and NPL Ratio

The second strand of the literature has focused on studying the influence of bank specific factors (BSF) on problem loans of banking sectors. Li, Rozelle, and Zhou (2007) explored bank specific factors and revealed that incentive contracts have a favourable effect on managerial efforts to keep NPLs in the Chinese banking system under control. Hue (2015) explored the factors accountable for NPL in the banking system of Vietnam for the period 2010-12. The study reveals that NPL ratio has positive association with NPL ratio of next year. Loan-to-asset-ratio and public ownership of banks were also found augmenting NPL ratio in the Vietnamese banking system. Masood & Aktan (2009) studied the role credit managers for its clout on asset quality of large state owned Pakistani and Turkish commercial banks. Analyzing the data of 100 Turkish credit managers for the period 1996-1998 and 110 Pakistani credit managers for the period 1991-2001, the study concluded that in Turkey the government intervention, low standard of credit risk evaluation and loan to employees enhanced NPL ratio. For Pakistan credit managers' basic and professional education, experience (number of years of service), number of specially arranged courses attended by them and communication facilities provided to credit managers play significant role in controlling NPL of banks. Credit limit

for individual borrower was also found to have a favourable effect on NPL of banks in Pakistan and Turkey.

2.3.3 Industry Specific Indicators and NPL Ratio

The third category of studies has delved upon industry specific indicators (ISI) for studying its clout on NPL ratios. Ngugi (2001) studied the impact of intermediation cost (interest rate spread) of overall banking sector over its NPL and discovered that increased spread causes NPL to inflate. Siddiqui et al., (2012) applying generalized autoregressive conditional heteroskedasticity, explored the Pakistani banking system for influence of interest rate volatility on its asset quality (NPL), using the data for the period 1995-2011. Their findings signify that interest rate volatility has significant sway on NPL. These studies have again focused on a small portion of the big multifaceted picture.

2.3.4 Macroeconomic Indicators and/or Bank Specific Factors and/or Industry Specific Indicators

The fourth category of studies includes the ones which have taken stock of Macroeconomic Indicators, Bank Specific Factors and/or Industry Specific Indicators for its reign on NPL ratio of banks. Männasoo and Mayes (2009) investigated the collective role of macroeconomic, structural and bank-specific indicators in elucidating its influence in the occurrence of banking problems. Using the data of the nineteen Eastern European transition countries, over the first decade of the 21st century, the study applied logit model for the empirical analysis. Results of the study denotes that these three types of factors interact with each other and therefore have a rich and dynamic impact creating a highly volatile cyclical effect on stability of commercial banks. The study concluded that exposure to equity, currency, interest rate and commodity risks, coupled with weak equity base and volatility in the values of macroeconomic indicators are the main factors responsible for stressed banking assets. Roberto and Ricardo (2012) explored the dynamic behaviour of default ratios in Spanish banking sector for loans advanced to the

household. The study used two different definitions of non-performing loans; first based on the proportion of the amount of loans in default and second the proportionate number of defaulted borrowers. Both types of the default ratios were estimated separately for secured as well as unsecured loans. The data used was obtained from a panel of 50 provinces, covering the period 1984-2009. During this period the Spanish economy had seen two significant crises. The models have been estimated using two-step system Generalized Method of Moments (GMM) approach. The study identified unemployment rate as the most influencing factor affecting default loans during the crisis period 2007-09. Falling interest rate was noted to bring down NPL ratio during 2009 in Spanish economy. An interesting phenomenon was noticed in the response of default loan to unemployment. Default ratio demonstrated more sensitivity to increase in the rate of unemployment than reduction in it. Compared to saving banks, the response of banks to trade cycle was found more sensitive. Dash and Kabra (2010) used panel data for the period 1999-2009 to explore the impact of macroeconomic and bank level indicators on NPL ratio of commercial banks of India. The study used economic activity surrogated by GDP growth, real interest rate, loans to total assets ratio, real effective exchange rate, inflation, bank size and growth in loans as explanatory variables. The study found real effective exchange rate and real interest rate having significant positive influence on NPL ratio. The loan growth, inflation and GDP growth were found to have significant negative association with NPL ratio of the banks reviewed. Festić, Kavkler & Repina (2011) conducted a study to appraise the clout of macroeconomic and bank specific indicators as the source of systematic risk and to evaluate susceptibility of banking sector of five newly member European Union States to overheating of economies. They used ratios of loan to assets, deposit to loan, gross fixed capital to GDP, net foreign assets to net assets, variation in foreign direct investment, exports and reward of employees with respect to household demand as independent variables. The model they applied for the empirical analysis was panel regression fixed effect as well as random effect. Results of their study denote that high loan to assets ratio augments NPL ratio, which further suggest that to meet the increasing demand for funds for investment during boom period

of business cycle, the bank management softens up the terms and conditions for issuing the loans and therefore assume comparatively high risk. The study finds a positive clout of growth in the foreign direct investment (FDI), gross fixed capital, exports and industrial production over GDP growth and thus decreasing the NPL ratio. An important conclusion of the study was that a high rate of GDP growth is indicative of high rate of economic activity and boom phase of trade cycle which means that in the next phase i.e. recession, rate of GDP growth and economic activity is going to decline and NPL ratio to go up. Ćurak, Pepur, and Poposki. (2013) empirically assessed macroeconomic and bank specific factors for its sway on NPL ratio of Southeastern European banking systems. The analysis used data of 69 banks operating in 10 different economies during the period 2003-2010. To estimate NPL ratio Generalized Method of Moments model was applied to the data. Results of the study indicate that in macroeconomic indicators, GDP growth has negative while inflation and interest rates have positive clout on NPL ratio. In bank specific factors, bank size, management performance (surrogated by ROA), and liquidity were recognized for their negative influence on NPL ratio of the banks reviewed. Using a dynamic panel data set of 75 countries during the period 2001-10, Beck, Jakubik, and PiloIU (2013) explored the macroeconomic and bank level variables for its clout on non-performing loans (surrogated by NPLs/-gross loans). In macroeconomic factors GDP growth was found to have negative effect contemporaneously and positive lag effect. Contemporaneous and lagged effect taken together was found to have negative bearing on non-performing assets. The nominal effective exchange rate (NEER) was found to have positive influence on NPL ratio, which connotes that depreciation of the domestic currency leads to a decline in nonperforming loan ratios of banking system. In bank level factors, lending interest rate was found to have a significant positive while share price of bank was found to have negative association with its NPLs ratio. Louzis, Vouldis and Metaxas (2012) employing the data for the corporate, consumer and mortgage loans for the period 2003 to 2009, scrutinized bank level and macroeconomic variables for its relation with loan losses of the Greek banking sector. The study explains the relation between various stages of business cycle and non performing

assets of banking sector. During boom, the banks advance loans to low quality businesses which become unprofitable during the next stage of business cycle i.e. recession and therefore bad debt increases. During recovery phase there are less business activities and only efficient businesses operate. These businesses become more profitable during next phase of cycle i.e. boom and repay their debt as per schedule. The study finds positive relation between rate of unemployment and NPL. In bank specific factors lending rate was found to have bolstering effect on bad debts while management quality identified for having significant negative bearing on loan losses of banking system of Greece. Employing the data covering the period 2003-09, Louzis et al., (2012) examined the behavior of asset quality (NPL) of nine largest Greek banks under the influence of various MEI and bank specific factors. Using generalized method of movement, the results of empirical analysis manifest that in macroeconomic indicators, the real GDP growth has negative, while unemployment and lending rate have positive bearing on NPL. In bank specific factors, management efficiency (performance and quality of management) and individual bank's application of risk management techniques were found to have significant negative leverage on NPL. Using panel data for the period 2004-2008 of 85 banks from Italy, Greece and Spain, Messai and Jouini (2013) probed various macroeconomic and bank specific variables for its impact on NPL. GDP growth and return on assets were found negatively affecting NPL of banks. Unemployment rate, the loan loss reserves to total loans and the real interest rate were on the other hand, found to be positively associated with non performing loans in these economies. The study suggests that with a view to restrict NPL ratio, banks should keep many variables like phase of trade cycle, international competitive environment faced by local businesses, level of employment of all factors of production specially human resource etc under close scrutiny. The study connotes that these factors influence rate of return and income of business firms and individuals and thus affect their capability to meet their debt obligations. Employing the data for the period 1998-2011, Klein (2013) scrutinized the behaviour of asset quality of Central, Eastern and South-Eastern Europe (CESEE) banking systems

for the influence of macroeconomic and bank level factors on it. The results support the proposition that macroeconomic and bank-level factors have significant effect on NPLs. As far as the macroeconomic indicators are concerned, the results imply that higher rate of unemployment, exchange rate depreciation and higher inflation have positive association with NPLs. As expected the GDP growth was found to have negative relation with loan losses. The impact of BSF was found in agreement with other past studies on the subject. Equity-to-asset ratio and return on equity (ROE) were found negatively correlated with NPLs. Excessive lending represented by loan-to-asset ratio and the past growth rate of banks' lending were found to have positive influence on NPLs. Although the influence of bank specific factors i.e. equity to assets ratio, ROE, loans to assets ratio on NPL was found to be statistically significant, their explanatory power in terms of change in NPL was found to be low. Castro (2013) examined the standing of the macroeconomic developments in bringing any change in the banking sector credit risk in Greece, Ireland, Portugal, Spain and Italy (GIPSI). Applying dynamic panel data approach to the banking sectors of these economies for the period from first quarter of 1997 till third quarter of 2011, the study concluded that GDP growth, share and house price indices have negative effect on NPL ratio while the rates of unemployment, interest, and credit growth have affirmative clout on NPL of banking sectors of the countries reviewed by the study. Fainstein and Novikov (2011) analyzed the sway of bank level, macroeconomic indicators and real estate market variables on asset quality of banking sectors of three Baltic States i.e. Estonia, Latvia and Lithuania. The four variables finally chosen were lag effect of ratio of non-performing loans to the aggregated loan portfolio of banks, growth rate of a banks' aggregated loan portfolio, variation in real GDP, rate of expansion in the real estate market (Estonia only) and level of unemployment. As far as macroeconomic indicators are concerned, results of the study suggest that clout of the real GDP growth on NPL is time lagged owing to the reason that the other variables linked to GDP growth i.e. employment rate, productivity, price level, income level of businesses and individuals etc move with some time delay and not parallel to GDP growth. In other words there is a time lag for other variables to adjust to

changes in GDP. The study concluded that the level of NPL ratio was positively related to this adjustment period. Growth rate of banks aggregated loan was found to have positive lag effect on NPL. The study denotes that to meet target revenue, the banks extends more loans without adequate analysis of risk exposure. Growth in real estate was found to be a profitable business with negative influence on NPL ratio. Bofondi and Ropele (2011) employed a single-equation time series approach to explore the macroeconomic and bank level indicators for its impact on NPL, represented by the ratio of new loans to that of preceding year's loan. Assuming that macroeconomic indicators influence household and business loans differently, the quality of loans extended to the borrowers of these sectors was examined separately. Results of the study indicate that for household borrowers, variation in real GDP and house prices are inversely related to NPL, while the rate of unemployment and interest rates have positive clout on NPL ratio of Italian banking sector. As for as advances to business firms are concerned, the NPL ratio was found to move in tandem with variation in rates of unemployment and the ratio of net interest expenses to gross operating profits. The NPL ratio was however noticed to have negative relation with changes in the sale and consumption of durable goods. Almost all determinants mentioned above affect the NPL ratios with different time lags. Alhassan, Kyereboah and & Andoh (2014) using data of twenty five banks for the period 2005-2010, examined the factors accounting for the deterioration of the asset quality of Ghanaian commercial banks during a period of financial crises. The study concluded that persistence non-performing loans, loan growth, size of the bank, rate of inflation, real exchange rate depreciation and GDP growth were the factors having significant clout on asset quality of Ghanaian commercial banks. Abid, Ouertani and Zouari-Ghorbel (2014) analyzed data of 16 Tunisian banks for the period 2003-2012 for influence of macroeconomic, industry specific and bank specific factors on its household NPL. Results of the study denote that real GDP growth increases income of households, and has a negative effect with a time lag of 3 and 6 months on their NPL ratio. Inflation rate was found to have positive relation with NPL ratio of house hold debt. In industry specific indicators, interest rate surrogated by real lending rate was noticed to have positive association with

NPL ratio of household debt with floating rate. In bank specific factors, ROE was used to represent performance of management and observed to have negative relation with NPL. In order to determine significant macroeconomic, financial and structural variables, Jahn and Kick (2014) got confidential supervisory reporting data of 3,330 institutions for the period 1995-2010 from Deutsche Bundesbank and applied panel regression techniques on it. The study considered two groups of macroeconomic indicators i.e. 'asset price indicators' represented by national real estate price index, and 'leading indicators for business cycle' represented by business cycle expectation and gross fixed investment. Financial variables studied were also composed of two groups i.e. lending indicator represented by national private credit to GDP, and money market indicator represented by London interbank offered rate and M2 to GDP. The structural variables analyzed in the study were divided into four groups i.e. regional spillovers (represented by assets weighted probability of default for the institutions in the same country, counterparty exposure (proxied by international exposure in terms of balance sheet total), risk aversion (represented by indicator of risk appetite, and bank size (represented by bank's assets). The study identified asset price and money market indicators along with leading indicators for the business cycle as reliable early warning indicators for banking system stability. The study also identified international spillover effects having significant role for banking system (in)stability. The regional spillover effects and German national credit-to-GDP ratio were however found to influence credit cooperatives and having no significant effect on commercial banks.

Review of recent past studies (Prasanna 2014; Ahmad and Bashir, 2013) discerns that independent researchers have studied the factors affecting NPL ratio of Pakistani and Indian financial sectors. Assessing NPL ratio for influence of other factors is tantamount to examine one side of the picture. Like any other business, a financial institution remains solvent and stable till the time it has positive value of shareholders' equity (Drehmann et al., 2011). Shareholder's equity also plays a vital function to act as buffer against endogenous and exogenous shocks. Studies which have reviewed stability of financial sectors of Pakistan and India have so far overlooked the functions of shareholders' equity. A systemic banking crisis is

defined as the case when almost all of the capital in the banking system is eliminated by loan losses (Caprio and Klingebiel, 2003). Great depression of 1930s and financial crisis of 2008 are examples of systematic crises. In such a situation either liabilities of the banks surpasses its assets (and are therefore insolvent) or the remaining assets are comparatively illiquid and to meet immediate cash demand of the depositors banks require time to convert the same into liquid assets. If the bank desires to sell the illiquid assets like loan book, bonds etc in less time it can be done by offering attractive discount rates to its buyer. If loss accruing due to discount offered is greater than that of the equity, the bank will turn insolvent. Capital or shareholders' equity is thus a buffer against shocks and insolvency and a bank like any other business becomes insolvent when all of its equity is wiped out by loan losses (Drehmann et al., 2011). High NPL ratio therefore does not mean financial instability or insolvency. Banks with high equity values can go for high risk high return advances and investment. Similarly low NPL ratio is not necessarily an indicator of good financial health. It may be an indication of low risk appetite on the part of management. Less risk assuming may cause low return and thus low profitability. Accordingly there is always a tradeoff between low and high risk appetite. High risk does not simply mean higher NPL ratio but it also means higher return and vice versa for low risk assuming. Here comes in management's efficiency and especially risk management techniques applied by risk managers. Studies by independent researchers have so far focused on NPL ratios only and have overlooked equity position vis-à-vis NPL ratio. A bank with sound equity position can not only face stressed loans but also withstand external shocks coming from price volatility and macroeconomic disturbances (Gersbach & Wenzelburger, 2010).

This study is undertaken to fill the gap identified in the preceding paragraphs. The study is going to first identify factors affecting NPL ratio of financial institutions, estimate credit losses (NPL ratios) under the influence of these factors, compare the estimated NPL ratio with capital ratio (equity/advance) of respective financial institutions and thus assess its stability. Stress testing of individual financial institutions and whole banking system shall be carried out under various scenarios

developed on the basis of extreme values of macroeconomic and industry specific indicators during sample period. To tag a bank stable (or otherwise), this study not only estimates NPL ratios of a bank in a certain year but compare it with its capital position in the same year. Results of this study are therefore, expected to be different from the previous ones. Stability of whole banking system hinges on the state of stability of its' banks, therefore, results of this study are expected to be different from the past studies.

Chapter 3

Data Description and Research Methodology

3.1 Research Design

Our design of study is a mix of the designs used by independent analysts and regulators. Determinants of asset quality of commercial banks are detected and its influence on NPL ratio explored empirically. The model used in stress testing and scenario analysis are employed but in simplified form. Pakistan and India have not experienced financial crisis due to some shock/contagion, therefore stress events and its impact on macroeconomic indicators are not included in the design. However, scenarios are developed for stress testing on the basis of extreme values of macroeconomic variables during sample period and its influence on the stability of individual financial institutions and whole banking system explored.

3.2 Banking Sectors of Pakistan and India Analyzed Separately

Banking systems of Pakistan and India are explored separately. The banking systems are not combined for analysis due to difference in sample periods and difference in clout of independent variable on NPL ratio. To get balanced panel data,

only those commercial banks are included in the study, which were found continuously operating during the sample period. Another consideration for selecting the sample banks is its size. Big banks are in control of big share in terms of assets as a percentage of the total assets of whole banking system and have therefore more clout on the (in) stability of the financial system. These considerations made us chose different sample periods i.e. 1999-2014 for Indian financial system and 1998-2014 for Pakistani banking system. Getting insight from past studies reviewing financial systems of Pakistan and India, same bank specific factors (BSF), industry specific indicators (ISI) and macroeconomic indicators (MEI) are found to have different influence on NPL ratio (our dependent variable) of these systems. To get the best model fit, therefore it is deemed more appropriate to assess the financial systems of India and Pakistan separately.

3.2.1 Steps of Research

Each financial system is appraised separately in five steps.

In step one, using data of the sample banks during the sample period, an empirical model is developed for estimation of NPL/advance ratio by using multivariate regression analysis on various indicators. The indicators include various macroeconomic indicators (MEI), bank specific factors (BSF) and industry specific indicators (ISI). Empirical model was developed separately for Pakistan and India.

$$\text{NPL/advance} = \alpha_0 + \alpha_1(\text{BSF})_{i,t} + \alpha_2(\text{ISI})_{i,t} + \alpha_3(\text{MEI})_{i,t} + \xi_{i,t} \quad (\text{Model 1})$$

where α_0 is intercept coefficient and α_1 , α_2 and α_3 are slope coefficients. ξ is error term.

In second step, the robustness and validity of the model is tested by ‘back testing’.

In step three, the empirical model is employed to evaluate the stability of all the banks during sample period. A bank is considered unstable during a year (operational definition) if its estimated NPL/advance exceeded its equity/advance. The results were also used to ascertain the stability of whole banking sector during sample period. Banking sector is termed unstable, less stable or stable during a year (operational definition) if total assets of all banks assessed as unstable respectively were more than 20%, 10-20% or less than 10% of total assets of all the sample banks.

In step four, using empirical model, stress testing of all the sample banks is carried out under various scenarios. Scenarios are developed on the basis of extreme values of significant macroeconomic indicators.

In step five, stability of banking sector is determined in all the sample years under various scenarios. In a scenario, banking sector is termed unstable, less stable or stable during a year if total assets of all banks assessed as unstable respectively are more than 20%, 10-20% or less than 10% of total assets of all the sample banks.

3.3 Variables of Study

On the basis of detail review of existing literature and peculiar macroeconomic environment of Pakistan and India, following variables were chosen to be studied for its quantitative influence on NPL/adv of sample banks selected for the study. The variables investigated can broadly be grouped in three categories namely; Bank Specific Factors (BSF), Industry Specific Indicators (ISI) and Macroeconomic Indicators (MEI).

3.3.1 Variables

3.3.1.1 Dependent Variable-Non-Performing Loans/Gross Advances (NPL/Adv)

Literature on stability of a financial sector and individual financial institutions suggests that NPL ratio is the most popular variable used for measuring stability

of a financial sector (Boudriga, Taktak & Jellouli, 2009; Dash & Kabra, 2010; Louzis et al., 2012; Festiic et al., 2011; Waweru & Kalami, 2009; Guy, 2011; Hu, Jin-Li, Yang Li & Yung-Ho, Chiu, 2006; Siddiqui et al., 2012). This ratio is computed by dividing the NPL of a bank by gross advances made by the bank during a banking year. The ratio is used to ascertain the quality of loan portfolio of a commercial bank in terms of loan loss. The dependent variable i.e. NPL/adv is from BSF category. In other words data of NPL/adv of each commercial bank included in the sample is utilized for the purpose. Data of NPL/adv was taken from individual bank's annual accounts (1999-2014).

$$\text{NPL/Adv} = \text{Non-Performing Loans during a year/Gross Advances}$$

3.3.2 Independent Variable

3.3.2.1 Bank Specific Factors (BSF)

Returns on Equity (ROE)

ROE is a profitability ratio that denotes the ability of a firm (in this paper bank) to generate profits by investment of its shareholders money. This ratio denotes the profit each dollar or unit of currency of ordinary stockholders' equity generates. ROE is an important indicator of management efficiency. The return on equity is a ratio and calculated by dividing net annual income of a bank by its shareholder's equity. The equity is sum of share capital, reserves and surplus of the bank.

$$\text{ROE} = \text{net income}/(\text{Total equity} + \text{Total equity at the end of previous year})/2 \times 100$$

ROE is expected to be negatively related to NPL/advance ratio. High rate of ROE means an effective and efficient management and high profitability, thus little chances of financial fragility (Chishti, 2012). Data of ROE is obtained from annual accounts and financial statements (1999-2014) of respective banks.

Net Interest Income/Total Assets (NII/TA)

Interest income is the differential (surplus or deficit) between interest earned from loans to borrowers (and other banks) and interest paid to individuals with deposits at the bank (and other banks). The value of net interest income is obtained by deducting provisions from interest income. NII/TA is a ratio of banks' profitability reflecting bank management efficiency.

$$\text{NII/TA} = \text{Net Interest Income/Total Assets}$$

High value of NII/TA reflects efficient management and is expected to have negative bearing on NPL/advance ratio (Louzis et al., 2012). Data for NII/TA of commercial banks is obtained from their respective annual accounts (1999-2014).

Capital Adequacy Ratio (CAR)

CAR is a measure of a bank's capital to its risk and thus determines its capacity to absorb shocks. Its' value is calculated by dividing the sum of a bank's Tier I, Tier II and Tier III capital on sum of the bank's risk weighted assets. Tier I capital is composed of shareholders' equity and retained earnings. While revaluation reserves, loan-loss reserves, hybrid securities (having both debt and equity characteristics), subordinated debt, and undisclosed reserves constitute Tier II capital. Tier III capital has the same combination as that of Tier II but have comparatively more subordinated issues, undisclosed reserves and general loss reserves. Tier I capital is a measure a bank's financial health and indicator of bank's capability to absorb losses without ceasing business operations. Tier II and Tier III capitals are supplementary in nature and less reliable than Tier I capital.

$$\text{CAR} = \text{Tier I} + \text{Tier II} + \text{Tier III (Capital)}/\text{Risk weighted assets}$$

The risk weighted assets (RWA) refers to a bank's assets such as cash, loans, investment or off balance sheet activities. Off balance sheet activities refers to

assets, debt or financing operations not on balance sheet of the bank. These are assets of the bank. However, keeping in view the risk associated with an asset, a risk weight is assigned to each asset. For example cash and government guaranteed securities are safest and therefore 0% risk weight is assigned to it. On the other hand, capital market exposure like venture capital is risky and risk weight of 150% assigned to it. Similarly bank's clients (borrowers) are graded as per their past credit record and different risk weights assigned accordingly. The RWA is calculated on the basis of Basel III minimum capital requirement and risk weights. For example if a risk weight of 20% is assigned to a client and minimum capital requirement is 9%, the bank needs to set aside Rs 1.8 ($20\% \times 9\% \times 100$) for each Rs. 100 loan to that client. Review of past studies suggests that in most cases the capital adequacy has negative influence on levels of non-performing loans (Pastory & Mutaju, 2013). Data of RWA was taken from individual bank's annual accounts (1999-2014).

Ratio of Non Performing Loan to Gross Advances Lag Effect (NPL/Adv_{n-1})

Past studies on the subject reveal that NPL ratio has a time lagged effect on itself. Following suit, in this study NPL ratio was also studied for its lag effect. Keeping in view results of the past studies, a positive influence was expected on contemporary NPL/adv ratio (Nkusu, 2011; Fainstein and Novikov, 2011; Hue, 2015).

$$\text{NPL/Adv} = \text{Non-Performing Loans during a year/Gross Advances}$$

Ratio of Investments in not Approved Securities to Total Investments (Invunapprsec)

A government approved security is a tradable instrument such as Treasury bill, bond, etc issued by the Central or State/Provincial governments. It is an acknowledged debt obligation with a promise of repayment upon maturity. Government's

securities carry almost zero risk of default and are therefore regarded highly reliable investment. The only problem with investment in governments' approved securities is its' low rate of return. Therefore, banks with high risk appetite invest some portion of its investible funds in other than approved securities. The ratio of Invunapprsec is calculated as under:-

$$\text{Invunapprsec} = \text{Investment in non-approved securities} / \text{Total investments}$$

Review of past studies on the subjects suggest that Invunapprsec may be having positive or negative influence on NPL ratio depending upon the effectiveness of a bank's application of its risk management techniques (Roberto and Ricardo, 2012; Louzis et al., 2012). Data for investment in not approved securities and total investments of commercial banks is obtained from their respective annual accounts during sample period.

Gross Advances/Borrowing & Deposits (GAdv/Borr & Dep)

This ratio is one of the liquidity ratios and reflects the percentage of gross advances to borrowing and deposits in intermediation process of a bank which is a bank's core business. The ratio is calculated by dividing the total amount of gross advances of a bank over sum of its borrowing (from financial and other institutions) and deposits.

$$\text{GAdv/Borr \& Dep} = (\text{Gross Advances/Borrowing \& Deposits}) \times 100$$

Higher value of Gross Advances/Borrowing & deposits reflects bank management higher appetite for risk by resorting to excessive lending. However, a very small value reflects inefficiency of management by keeping funds idle and not using it for earning profit. Gross Advances/Borrowing & deposits is therefore expected

to have positive influence on NPL/Adv ratio (Klein, 2013). Data for Gross Advances/Borrowing & deposits of commercial banks is taken from their respective annual accounts and financial statements during sample period.

3.3.2.2 Industry Specific Indicators (ISI)

Interest Rate Spread (IRS)

There are several definitions and therefore different methods for calculating IRS in the literature. In this study interest rate spread is calculated by subtracting weighted average interest rate on deposits (WAIRD) from weighted average interest rate on advances (WAIRA) of overall banking sector.

$$\text{IRS} = \text{WAIRA} - \text{WAIRD}$$

Higher IRS means higher cost/burden for the borrower in the shape of higher lending rates. Various studies investigating relation between higher IRS and higher lending rates have shown conflicting results. According to Berge and Boye (2007), Khemraj and Pasha (2009) and Asari et al. (2011) higher IRS enhances cost of borrowing and thus increases non performing loans of financial institutions. On the other hand, Louzis et al., (2012) testify that higher IRS has negative influence on NPL. They are of the opinion that when demand for loans is higher, bank managers increase IRS by increasing lending rates. However, they also demand more guarantees from borrowers and thus ensure timely return of their principal as well as interest amount from the borrowers. Data of IRS was obtained from websites of State Bank of Pakistan¹ and Reserve Bank of India².

Interest Rate (Intr)

The amount that is paid by a borrower to a lender, expressed as a percentage of principal amount for the use of assets. Interest rates are typically calculated

¹http://www.sbp.org.pk/publications/anu_stats/2015.htm

²<https://rbi.org.in/Scripts/AnnualPublications.aspx?head=Statistical+Tables+Relating+to+Banks+in+India>

on an annual basis and such rates called as annual percentage rates. From a commercial banks' perspective, the rate of interest depends upon factors like rate of interest paid to its depositors, cost to cover risk of default of borrowers, cost of management and administration of the bank and shareholders' expectations for return on their investment. In this study interest rate is represented by Repo rate. It is the rate charged by central banks of a country (Reserve Bank of India in case of India) on money borrowed by commercial banks. An overview of literature on the subject suggests that interest rate is positively correlated to NPL ratios as higher interest rates enhances cost of doing business and thus increase price level. Resultantly producers and consumers debt returning capabilities are adversely affected. Interest rate is therefore expected to have positive influence on NPL ratio (Messai and Jouini, 2013). Data of interest rate is obtained from websites of State Bank of Pakistan³ and Reserve Bank of India Reserve Bank of India⁴.

3.3.2.3 Macroeconomic Indicators (MEI)

Data of all MEI variables was obtained from various editions of Economic Surveys of Pakistan⁵, India⁶ and World Bank Website World Bank Economic Indicators⁷.

Inflation

An economy is said to be in a state of inflation when its unit of currency buys fewer goods and services. Increase in the amount of money in circulation in an economy is also termed as a state of inflation. Majority of the studies have used change in consumer price index (CPI) to proxy inflation. Following their footprint, this study also uses CPI to represent inflation.

$$CPI = (CPI_n - CPI_{n-1})/CPI_n$$

³http://www.sbp.org.pk/publications/anu_stats/2015.htm

⁴<https://rbi.org.in/Scripts/AnnualPublications.aspx?head=Statistical+Tables+Relating+to+Banks+in+India>

⁵http://finance.gov.pk/survey_1415.html

⁶<http://www.oecd.org/economy/economic-survey-india.htm>

⁷data.worldbank.org/indicator

CPI_n means consumer price index of the current year and CPI_{n-1} consumer price index of the preceding year. Literature on relation between inflation and assets quality of commercial banks is unanimous in supporting positive influence on NPL (Hoggarth et al. 2005; Vogiazas & Nikolaidou 2011). The purpose of including inflation in this study is to confirm its positive influence and also to study its quantitative implications on assets quality of banks in Pakistan and India.

GDP Deflator (GDPDefl)

Majority of the studies have used change in consumer price index (CPI) to proxy inflation. However, GDP Deflator is also a popular measure of inflation. Consumer price index (CPI) takes into account the prices of a selected basket of consumer goods and monitor changes in it. GDP deflator on the other hand, measures the overall level of prices of all new domestically produced, finished goods and services. As compared to CPI, GDPDefl is producers oriented and captures influence of inflation on producers.

$$\text{GDPDefl} = (\text{Nominal GDP}/\text{Real GDP}) \times 100$$

The purpose of including GDPDefl in this study is to assess long term impact of overall price level of all new domestically produced finished goods and services. Data of GDPDefl is obtained from IMF and World Bank's websites. Influence of GDPDefl on NPL ratio is expected to be negative especially in the long term as rising prices of newly produced finished goods and services enhance producers' capacity to meet its financial obligations (Bertay, Demirgüç-Kunt, & Huizinga, 2015; Festic et al., 2011).

Gross Domestic Product (GDP)

GDP is usually defined as monetary price (market value) of all finished goods plus goods in the pipeline for production/finishing plus the services produced within the geographical boundaries of an economy during a financial year. Growth in

GDP is considered to be indicative of enhanced economic activity by employing an enhanced quantity and more efficient use of factors of production. Inflation is also a factor affecting market value of GDP as higher value of inflation means higher market prices and thus higher nominal GDP. It may be noted that inflation is also one of the independent variables of this study. To circumvent this problem and disentangle influence of inflation from GDP growth, in this study market value of GDP is taken in US dollar terms (being a comparatively stable in terms of its value) and not in home currency.

$$\text{GDP} = (\text{GDP}_n - \text{GDP}_{n-1})/\text{GDP}_n$$

GDP_n means market value (in US dollars) of gross domestic products of the current year and GDP_{n-1} as that of the preceding year. Barring few exceptions, almost all the studies carried on the subject have revealed that GDP growth is negatively associated with NPL of commercial banks (Keeton & Morris, 1987; Sinkey & Greenwalt, 1991; Gambera, 2000; Lis, de & Saurina, 2000; Salas & Saurina, 2002; Rajan & Dhal, 2003; Fofack, 2005; Khemraj & Pasha, 2009; Bofondi & Ropele, 2011; Louzis et al., 2012; Klein, 2013). GDP growth is indicative of enhanced economic activity by employing an increased quantity and more efficient use of factors of production. Resultantly, the factors of production get higher reward and thus increase in income. Increased income enables people to meet their financial obligations as per schedule thus depleting the quantity of NPL of commercial banks. Relying on the results of related literature, intuitive knowledge and academic discussions, a negative influence of GDP growth was expected on the NPL ratios of the commercial banks.

Exchange Rate (ExchR)

ExchR is defined as the price of a nation's currency unit in terms of the currency unit of another country. ExchR are determined by the demand and supply of a currency foreign exchange markets. In this study the ExchR means the number

of units of home currency per US dollar. The value of the variable is converted to ratio form as following.

$$\text{ExchR} = (\text{ExchR}_n - \text{ExchR}_{n-1})/\text{ExchR}_n$$

ExchR_n means exchange rate during the current year and ExchR_{n-1} as that of the preceding year. Studies probing the relationship between ExchR and NPL of commercial banks have shown different results (Fofack, 2005; Khemraj & Pasha, 2009; Klein, 2013). A depreciating home currency on one hand, increases the prices of imported goods, causing inflation (and lowering income) and on the other hand, enhances bill for imported goods, resulting in enhanced burden to finance the letter of credits (LCs) already issued to importers by commercial banks, and therefore risk of default increases. On the other side however, revenue from exported goods and services increases strengthening the exporters' ability to return their debt well in time (Khemraj & Pasha, 2009; Klein, 2013). Thus depreciation of currency exerts two opposing forces on NPL of commercial banks. It is the balancing or equilibrium point of these mutually opposing forces which decides the final impact of depreciating ExchR on NPL of commercial banks of an economy.

Unemployment Rate (UnempR)

UnempR in an economy is calculated by first determining the total number of persons that have attained a certain age, are willing to work and actively seeking jobs. Then the number of unemployed persons is divided over the total number of labour force (employed plus unemployed persons). It may be noted that children, aged people and young people not willing to work and/or not actively seeking jobs do not make part of a country labour/work force. In a broader sense, unemployment does not mean unemployment of labour force only but it include all the factors of production i.e. land, labour, capital and organization. However, data of unemployment in that sense is not available. In this study unemployment was used for variation in unempR of work/labour force only.

$$\text{UnempR} = (\text{UnempR}_n - \text{UnempR}_{n-1})/\text{UnempR}_{n-1}$$

UnempR_n means unemployment rate during the current year and UnempR_{n-1} as that of the preceding year. Past empirical work on the subject provides substantial evidence of positive relationship between UnempR in the economy and non-performing loans of its financial system (Gambera, 2000; Babouèk & Janèar, 2005; Rinaldi & Sanchis-Arellano, 2006; Berge & Boye, 2007; Vogiazas & Nikolaidou, 2011; Bofondi & Ropele, 2011). Academic and intuitive explanation of this positive relationship is that an increment in the unemployment in an economy has adverse effect on the incomes and debt retiring abilities of the individuals. From producers' point of view, high unmpR means low income of individuals thus lowering demand for goods and services, resulting in depleting sale/revenue of firms. Investors/producers' debt retiring ability is adversely affected and NPL of commercial banks increased.

Foreign Direct Investment as Percent of GDP (FDIGDP)

Foreign direct investment (FDI) is investment made by a company or entity based in one economy, in a company or entity based in another economy.

$$\text{FDIGDP} = \text{FDI}/\text{GDP}$$

Ratio of FDI to GDP is expected to have negative effect on NPL ratio. High value of FDIGDP means more investment, more employment and more income, enabling every individual and firm to meet its financial obligations (Festic et al., 2011).

3.4 Scope of Research

3.4.1 Population

Population of this study is the banking sectors of Pakistan and India. To get balance panel data, only those commercial banks are included in the study, which are found continuously operating during the sample period. Another consideration for selecting the sample banks is its size. Big banks are in control of big share in terms of assets as a percentage of the total assets of whole banking system and have therefore more clout on the stability of the banking system. These considerations made us chose different sample periods i.e. 1999-2014 for India and 1998-2014 for Pakistan. Getting insight from past studies reviewing banking systems of Pakistan and India, same bank specific factors (BSF), industry specific indicators (ISI) and macroeconomic indicators (MEI) are found to have different influence on NPL ratio (our dependent variable) of these systems. To get the best model fit, therefore it is deemed more appropriate to assess the banking systems of India and Pakistan separately.

3.4.2 Sample

To ensure a balanced panel data, all commercial banks continuously operating in India and Pakistan during sample period are selected for this study.

The sample consists of eighteen commercial banks operating in Pakistan (Table 3.1) and seventeen commercial banks in India (Table 3.2), as schedule banks.

TABLE 3.1: List of Pakistan Banks Selected for Study.

	Name of Bank	Group
1	National Bank of Pakistan	Public Sector Bank
2	Habib Bank Ltd.	Private Sector Bank
3	United Bank Ltd.	Private Sector Bank
4	MCB Bank Ltd.	Private Sector Bank
5	Allied Bank Ltd.	Private Sector Bank
6	Bank Alfalah Ltd.	Private Sector Bank
7	Bank AL-Habib Ltd.	Private Sector Bank
8	Standard Chartered Bank (Pakistan) Ltd.	Foreign Bank
9	Askari Bank Ltd.	Private Sector Bank
10	Faysal Bank Ltd.	Private Sector Bank
11	Habib Metropolitan Bank Ltd.	Private Sector Bank
12	The Bank of Punjab	Private Sector Bank
13	Soneri Bank	Private Sector Bank
14	Bank of Khyber	Public Sector Bank
15	First Women Bank Ltd.	Public Sector Bank
16	KASB Bank	Private Sector Bank
17	Citibank	Foreign Bank
18	Deutsche Bank	Foreign Bank

TABLE 3.2: List of Indian Banks Selected for Study.

	Name of Bank	Group
1	State Bank of India	SBI And its Associates
2	ICICI Bank Ltd.	New Private Sector Banks
3	Punjab National Bank	Nationalized Banks
4	Bank Of India	Nationalized Banks
5	Canara Bank	Nationalized Banks
6	HDFC Bank Ltd.	New Private Sector Banks
7	IDBI Bank Ltd.	Nationalized Banks
8	Axis Bank Ltd.	New Private Sector Banks
9	Union Bank of India	Nationalized Banks
10	Central Bank of India	Nationalized Banks
11	Indian Overseas Bank	Nationalized Banks
12	Allahabad Bank	Nationalized Banks
13	Syndicate Bank	Nationalized Banks
14	Oriental Bank of Commerce	Nationalized Banks
15	Indian Bank	Nationalized Banks
16	Citibank N.A	Foreign Banks
17	Andhra Bank	Nationalized Banks

Chapter 4

Data Analysis and Results

4.1 Statement of the Problem Reviewed

In the recent past, financial systems of various economies of the world have experienced financial crises impairing its financial and real economies, causing hardships in the form of bankruptcy, unemployment, sharp decline in productivity, debt, poverty and homelessness (Rogoff & Reinhart, 2009; Dinos and Ashta, 2010). Developed economies have the potential to absorb such shocks. Developing economies like Pakistan and India do not possess enough financial capacity to withstand shocks. Therefore the only option they have is to avoid such situations through preemptive and preventive measures. Financial crises have forced international financial institutions and regulators of financial sectors to thoroughly monitor the financial entities (Vinals, 2012). They have developed methods and techniques of stress testing and scenario analysis to apprehend any gray area in a financial entity. However the findings of their analysis are not made public, being market sensitive (Smaga, 2013). Majority of the stakeholders like depositors, independent analysts etc therefore do not have any access to such information.

Academicians and practitioners have limited access to data. All information required for stress testing is not disclosed by financial institutions sometimes even to IMF staff (Jobst, Ong and Schmieder, 2013). Therefore, researchers/practitioners

have to restrict their selves to publicly available information. This study has also been conducted on publicly available data.

Like other developing economies, stability of financial sectors of Pakistan and India has not been investigated comprehensively by independent researchers. Studies made so far have restricted its scope to some specific group of factors affecting financial strength (represented by NPL ratio) of some specific types of banks. Assessing NPL ratio for influence of other factors is tantamount to examine one side of the picture. Like any other business, a financial institution remains solvent and stable till the time it has positive value of shareholders' equity. Equity position has a vital function to act as buffer against endogenous and exogenous shocks (Drehmann et al., 2011). Studies which have reviewed financial sectors of Pakistan and India have so far overlooked this function of shareholders' equity.

Absence of credible and precise information about banking systems of Pakistan and India has created suspicion in the mind of stakeholders specially the depositors. The situation is exacerbated by negative reports in electronic and print media about some of the commercial banks like KASB Bank and Bank of Punjab in Pakistan¹. After thoroughly reviewing Indian financial sector in 2011, IMF had expressed concerns over the constant deterioration of its assets quality and fragile liquidity position. In the Financial Stability Report (FSR) released in June 2015, Reserve Bank of India has also maintained that the non-performing assets of commercial banks especially public sector banks have an upward trend, and that profit margins of Indian corporate sector are declining adversely affecting its debt repayment capacity. Financial systems of Pakistan and India therefore, warrant a thorough empirical scrutiny by independent researchers.

This study is different than previous studies as following ways.

Financial systems of India and Pakistan are being assessed for its robustness to absorb macroeconomic shocks but do not share its findings about financial entities especially about weak ones (Smaga, 2013). Analysts (other than central banks staff) have evaluated the financial systems but have restricted its scope to some

¹State Bank of Pakistan, External Affairs Department, press release, May 7, 2015

specific group of factors affecting asset quality (represented by NPL ratio) of some specific types of banks.

- These studies have overlooked the analyses and function of shareholders' equity.
- Robustness of the financial institutions and overall banking systems to withstand macroeconomic shocks has not been reviewed.

This is the first study by analysts (other than central banks staff), assessing the banks as well as overall banking systems:-

- By taking into consideration the role of shareholders' equity.
- Its tenacity to absorb macroeconomic shocks by stress testing and scenario analyses.

4.2 Results of the Study-Pakistan

4.2.1 Results of Diagnostic Tests

Diagnostic tests of the data are carried out. Results of descriptive statistics, Multicollinearity test, LM Test and Autocorrelation are reported below. Table 4.1 reports the results of descriptive statistics. Descriptive statistics is used to examine the statistical behaviour of data.

Average non-performing loans as percentage of Gross advances (NPLADV) of the sample 18 commercial banks operating in Pakistan are 11%, touching a maximum level of 45% (UBL in 1998) and minimum level of 0% (mostly foreign banks) during sample period 1998-2014. The variation observed in non-performing loans during sample period is 8.5%. As evident from the results of Jarque-Bera test, the data of NPL is not normally distributed.

Average net interest income/total assets (NII) of the sample Pakistani banks is 2.9 during 1998-2014, reached a maximum level of 9.6% (Standard Chartered Bank of

Pakistan in 1998) and minimum level of -9.7% by the bank of Punjab during 2009. The variation observed in net interest income/total assets during sample period is 1.7%. As evident from the results of Jarque-Bera test, the data of net interest income/total assets is also not normally distributed.

Average gross advances/borrowing & deposits (ADVBRW) of the of the Pakistani banks are 50%, touching a maximum level of 79% (Faysal bank 2003) and minimum level of 16% (KASB bank during 2002) during sample period 1998-2014. The variation observed in gross advances/borrowing & deposits is 13%. As evident from the results of skewness (-0.2), kurtosis (2.6) and that of Jarque-Bera test (3.9), the data of gross advances/borrowing & deposits is normally distributed.

TABLE 4.1: Descriptive Statistic (Pakistan).

	NPLADV	NII	ADVBRW	IRS	GDP	GDP-DEFL	XCH
Mean	0.1158	0.0291	0.4999	0.054	0.0386	0.1059	0.010
Median	0.0994	0.0276	0.4986	0.055	0.0350	0.0766	0.010
Maximum	0.458	0.0965	0.7946	0.068	0.0766	0.2489	0.013
Minimum	0	-0.0973	0.1644	0.031	0.0101	0.0246	0.009
Std. Dev.	0.0857	0.0170	0.1307	0.009	0.0182	0.0635	0.000
Skewness	1.4815	-1.0769	-0.2026	-0.69	0.6844	0.9600	-0.47
Kurtosis	5.6257	14.672	2.6196	3.308	2.6353	2.6130	2.848
Jarque-Bera	198.53	1784.5	3.9137	25.85	25.423	48.5974	11.80

Note: NPLADV is non-performing loans to gross advances, NII is net interest income to total assets, ADVBRW is Gross advances to borrowing & deposits, IRS is Interest rate spread, GDP is GDP growth, GDPDEFL is GDP deflator, XCH is exchange rate.

Results of descriptive statistics denotes that average interest rate spread (IRS) of the Pakistani banking system was 5.4%, touching a maximum level of 6.8% (during financial year 2007) and minimum level of 0.3% during 2004. Interest rate spread has shown less variation i.e. 0.9% during the sample period of 1998-2014. The values of skewness (0.69), kurtosis (3.3) and that of Jarque-Bera test (25.8), suggest that the data of interest rate spread is normally distributed.

As far as data of GDP growth is concerned, results of descriptive statistics indicate that average GDP growth of the Pakistani economy was 3.8%, exhibiting variation of 1.8% during sample period, by reaching a maximum level of 7.6% (during year 2006) and minimum level of 1.0% during the year 1998. The values of skewness

(0.68), kurtosis (2.63) and that of Jarque-Bera test (25.4), indicates that the data of GDP is normally distributed.

The values of skewness (0.96), kurtosis (2.61) and that of Jarque-Bera test (48.59), suggest that the data of GDP deflator is normally distributed. Average value of GDP deflator of the Pakistani economy was 10.59%, exhibiting variation of 6.3% during sample period. Its value touched a maximum level of 0.2489 (during financial year 2001) and minimum level of 0.02 during 2003.

As far as data of change in exchange rate (XCH) is concerned, results of descriptive statistics indicate that average change in exchange rate of the Pakistani economy was 0.10, reached a maximum level of 0.013 (during financial year 2005) and touched the minimum level of 0.009 in 1999. The values of skewness (-0.47), kurtosis (2.848) and that of Jarque-Bera test (11.80), suggest that the data of exchange rate is normally distributed.

The statistical issues related to multicollinearity, autocorrelation and heteroskedasticity are also investigated. Table 4.2 reports the results of variance inflation factors (VIF) and tolerance (TOL). Variance inflation factors (VIF) and TOL measure the inflation in the estimated regression coefficients caused by linear relationship amongst predictor variables.

Maximum value of variance inflation factor is 1.36 (for GDP growth) followed by 1.28 for GDP Deflator at lag 2 and 1.25 for gross advances/borrowing & deposits. The values of variance inflation factors of the remaining predicting variables i.e. NPL/advance, net interest income/total assets, interest rate spread, GDP and exchange rate are near 1, which means that there is no significant linear relationship amongst predictor variables (O'Brien, 2007).

TABLE 4.2: Multicollinearity Test (Pakistan).

Variable	R-Square	VIF	TOL
NPADV(-1)	0.159	1.1890	0.841
NII	0.063	1.0672	0.937
ADVBRW	0.200	1.2500	0.800
IRS(-1)	0.140	1.1627	0.860
GDP	0.270	1.3698	0.730
GDPDEFL(-2)	0.223	1.2870	0.777
EXH	0.033	1.0341	0.967

Note: NPLADV is non-performing loans to gross advances, NII is net interest income to total assets, ADVBRW is Gross advances to borrowing & deposits, IRS is Interest rate spread, GDP is GDP growth, GDPDEFL is GDP deflator, XCH is exchange rate.

Table 4.3 reports the results of autocorrelation using Breusch-Godfrey serial correlation LM test. The value of F-statistic is insignificant indicating that no autocorrelation exists in the data.

TABLE 4.3: Breusch-Godfrey Serial Correlation LM Test (Pakistan).

Test	Result
F-statistic	0.568
Obs×R-squared	1.171
Prob. F(2,294)	0.567
Prob. Chi-Square(2)	0.556

The robustness of the results of the autocorrelation (Table 4.3) has been tested by using correlogram square residual (Table 4.4).

TABLE 4.4: Correlogram Square Residual (Pakistan).

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob.	
. .	. .	1	0.057	0.057	1.006	0.316
. .	. .	2	0.054	0.051	1.8999	0.387
. .	. .	3	-0.025	-0.031	2.0936	0.553
. .	. .	4	-0.027	-0.027	2.3153	0.678
. .	. .	5	-0.016	-0.01	2.3973	0.792
. .	. .	6	0.025	0.029	2.5905	0.858
. .	. .	7	-0.02	-0.023	2.7107	0.910
. .	. .	8	0.02	0.019	2.8417	0.944
. .	. .	9	-0.021	-0.02	2.981	0.965
. .	. .	10	-0.035	-0.035	3.3703	0.971
. .	. .	11	-0.025	-0.019	3.5763	0.981
. .	. .	12	-0.003	0.002	3.5792	0.990

The values of auto and partial correlation are near zero (Table 4.4). The probability values are high ($>.05$), which confirms that null of no autocorrelation stands validated.

4.2.2 Analysis of Results

Influence of bank specific factors, industry specific indicator and macroeconomic indicators was studied separately.

4.2.2.1 Impact of Bank Specific Variables on NPL

Results of the clout of bank specific factors on NPL/advance are reported in Table 4.5. Lag effect of NPL/advance has the most significant effect (t-stat = 19.8), followed by net interest income/total assets and advance/borrowing & deposit. As evident from its adjusted R-squared value (0.629), bank specific factors are responsible for 63 percent variation in the ratio of NPL ratio.

TABLE 4.5: Impact of Bank Specific Variables (Pakistan).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0913	0.0157	5.7886	0
NPLADV(-1)	0.7280	0.0366	19.8454	0
ADVBRW	-0.0825	0.0238	-3.4602	0.0006
NII	-0.6369	0.1782	-3.5732	0.0004
Adjusted R-squared	0.6294	F-statistic		173.16
S.E. of regression	0.0521	Prob(F-statistic)		0
Sum squared residuals	0.8179	Durbin-Watson stat		2.0295

Note: NPLADV is non-performing loans to gross advances, ADVBRW is Gross advances to borrowing & deposits, NII is net interest income to total assets.

4.2.2.2 Impact of Industry Specific Indicators on NPL

Result of the influence of interest rate spread (IRS), the only industry specific indicator being studied on NPL/Advance is reported in Table 4.6. As evident from the value of adjusted R-squared, variation in interest rate spread explains only 1.2 per cent variation in ratio of non-performing loans of Pakistani commercial banks.

TABLE 4.6: Impact of Industry Specific Indicators (Pakistan).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0595	0.029439	2.0234	0.0439
IRS(-1)	1.0344	0.53405	1.9369	0.0537
R-squared	0.0122	Log likelihood		319.16
Adjusted R-squared	0.0089	F-statistic		3.7515
S.E. of regression	0.0852	Prob(F-statistic)		0.0536
Sum squared residuals	2.2023	Durbin-Watson stat		0.4478

Note: IRS is Interest rate spread.

4.2.2.3 Impact of Bank Specific and Industry Specific Indicators on NPL

Table 4.7 reports the impact of bank specific and industry specific indicators on NPL ratio of Pakistani scheduled commercial banks. When interest rate spread is taken separately, it is significant at 90 percent confidence level. However, when taken together with bank specific factors, then its influence on our dependent variable becomes more significant (refer to t-Statistics and Prob. values in Table 4.7). However, whether studied alone or taken together for its influence on NPL ratio, there is no difference in the explanatory powers of industry specific and bank specific factors. The value of adjusted R-squared ascertains that bank specific and industry specific indicators explain 64.5 per cent variations in NPL ratio of commercial banks.

TABLE 4.7: Impact of Bank Specific and Industry Specific Indicators on NPL (Pakistan).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0179	0.0247	0.7236	0.4698
NPLADV(-1)	0.7395	0.0360	20.5266	0
ADVBRW	-0.0766	0.0234	-3.2760	0.0012
NII	-0.5469	0.1760	-3.1066	0.0021
IRS(-1)	1.2235	0.3232	3.7847	0.0002
R-squared	0.6498	F-statistic		139.207
Adjusted R-squared	0.6452	Prob(F-statistic)		0
Sum squared residuals	0.7806	Durbin-Watson stat		2.1062

Note: NPLADV is non-performing loans to gross advances, NII is net interest income to total assets, ADVBRW is Gross advances to borrowing & deposits, IRS is Interest rate spread.

4.2.2.4 Impact of Macroeconomic Indicators on NPL

Results of the influence of macroeconomic indicators on NPL ratio is reported in Table 4.8. It may be noted that when the influence of only macroeconomic indicators is studied, only GDP turns out to be having significant influence on

NPL ratio of Pakistani commercial banks. However, when lagged effect of NPL Ratio (lag 1), is added, GDP deflator and exchange rates also become statistically significant (Table 4.9).

TABLE 4.8: Impact of Macroeconomic Indicators on NPL (Pakistan).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0691	0.1112	0.6219	0.5345
GDP	-1.8876	0.2694	-7.0069	0
GDPDEFL(-2)	-0.0655	0.0776	-0.8435	0.3996
XCH	12.6484	11.1738	1.13197	0.2585
R-squared	0.1507	F-statistic		17.7553
Adjusted R-squared	0.1422	Prob(F-statistic)		0
Sum squared residuals	1.8934	Durbin-Watson stat		0.45061

Note: GDP is GDP growth, GDPDEFL is GDP deflator, XCH is exchange rate.

TABLE 4.9: Impact of Macroeconomic Indicators and NPL (lag 1) on NPL Ratio (Pakistan).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.1860	0.0721	-2.5802	0.0104
NPLADV(-1)	0.7437	0.0356	20.8729	0
GDP	-0.9623	0.1777	-5.4138	0
GDPDEFL(-2)	-0.1101	0.0497	-2.2159	0.0274
XCH	26.4423	7.1707	3.6875	0.0003
R-squared	0.6544	F-statistic		141.5305
Adjusted R-squared	0.6497	Prob(F-statistic)		0
Sum squared residuals	0.7706	Durbin-Watson stat		1.9102

Note: NPLADV is non-performing loans to gross advances, GDPDEFL is GDP deflator, XCH is exchange rate.

4.2.2.5 Lag Effect of NPL/Advance on Itself

Results of our empirical analysis (Table 4.5-4.10) discern that lag effect of NPL ratio on itself has the most significant effect and provides maximal explanation for the variation in NPL ratio.

TABLE 4.10: Impact of Macroeconomic Indicators and NPL (lag 1) on NPL Ratio (Pakistan).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0256	0.0052	4.9377	0
NPL/Advance(-1)	0.7788	0.0360	21.6167	0
R-squared	0.6066	F-statistic		467.2825
Adjusted R-squared	0.6053	Prob(F-statistic)		0
Sum squared residuals	0.8770	Durbin-Watson stat		1.9523

Note: NNPLADV is non-performing loans to gross advances.

4.2.2.6 Impact of Bank Specific, Industry Specific and Macroeconomic Indicators on NPL/Advance

Table 4.11 reports the combined effect of all types of significant variables on NPL ratio of Pakistani scheduled commercial banks. The values of F-stat, probability (F-statistic) suggest a good model fit. All independent variables are significant with $\alpha = 100\%$ except Advance/Borrowing & Deposit for which $\alpha = 95\%$. As evident from its' t-statistic values, lag effect of NPL/advance (bank specific factor) is the most significant, followed by interest rate spread which is an industry specific indicator. The next three significant variables are macroeconomic indicators i.e. GDP, GDP deflator and exchange rate.

TABLE 4.11: Impact of Bank Specific, Industry Specific and Macroeconomic Indicators on NPL Ratio (Pakistan).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.2061	0.0737	-2.7959	0.005
NPLADV(-1)	0.7294	0.0352	20.7255	0.000
NII	-0.5904	0.1672	-3.5302	0.000
ADVBRW	-0.0487	0.0237	-2.0561	0.040
IRS(-1)	1.3556	0.3259	4.1591	0.000
GDP	-0.8464	0.1781	-4.7507	0.000
GDPDEFL(-2)	-0.1907	0.0495	-3.8508	0.000
XCH	25.8020	6.8371	3.7738	0.000
R-squared	0.6920	F-statistic		95.0154
Adjusted R-squared	0.6847	Prob(F-statistic)		0
Sum squared residuals	0.6867	Durbin-Watson stat		2.0882

Note: NPLADV is non-performing loans to gross advances, NII is net interest income to total assets, ADVBRW is Gross advances to borrowing & deposits, IRS is Interest rate spread, GDP is GDP growth, GDPDEFL is GDP deflator, XCH is exchange rate.

4.2.3 Checking Robustness and Validity of the Model-Back Testing

Backtesting is a procedure used to check validity and predictive capability of a model using existing time series data. A test the robustness of our model is carried out by first estimating the values of NPL/advance of the sample banks during sample period 1998-2014. The values of equity/advance of the banks in that year are then deducted from the respective banks' estimated NPL/advance. Results of the back testing i.e. the value of equity/advance minus estimated NPL/advance are given below in Table 4.13. The negative sign indicates that NPL/advance of the bank has surpassed its equity/advance in the year under consideration and thus the bank is considered as unstable. The model accurately identifies KASB bank which was financially unstable since 2007, had to face a six months moratorium by Federal Government on recommendations of State Bank of Pakistan in 2014

and forced merger with BankIslami in April 2015 (Table 4.12). The model also correctly identifies Bank of Punjab, passing through a period of financial instability since 2008 and being rejuvenated by Punjab Government through continual money injections (Table 4.12).

Another evidence of the robustness of the model is that the signs of the coefficients are in tandem with those of the past studies on the subject (Table 4.7-4.11). Negative sign of inflation represented by GDP deflator (GDPDefl) is also not unanticipated but confirms the findings of Ahmad and Bashir (2013) for Pakistani commercial banks. Consumer price index (CPI) takes into account the prices of a selected basket of consumer goods and monitor change in it. GDP deflator on the other hand, measures the overall level of prices of all new domestically produced, finished goods and services. The negative relation of GDP deflator (Lag 2) suggests that price hike increases profitability of businesses and thus its ability to return the loan in the long term.

TABLE 4.12: Results of Test for the Robustness of the Model (Pakistan)-
Estimated NPL Minus Equity Ratios.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
KASB Bank	0.08	0.053	-0.026	-0.002	-0.106	-0.197	-0.074	-0.100	-0.151	-0.256
Bank of Punjab	0.20	0.063	0.060	-0.051	-0.302	-0.358	-0.449	-0.418	-0.335	-0.188

4.2.4 Stability Assessment of Banks (1998-2014)

The empirical model developed is employed to evaluate the stability of all the banks during sample period 1998-2014. Past studies do not provide any guidance for terming a bank stable or unstable on the basis of comparing the values of a bank's estimated NPL with its equity. Therefore for this purpose, a new operational definition is introduced in this study. A bank is considered unstable during a year if it's estimated NPL/advance exceeds its equity/advance during that year. Values of estimated NPL/advance minus its equity/advance during a year are given in Table 4.13. Negative sign of a value means that estimated NPL/advance of a bank has surpassed its value of equity advance during the year under consideration

and thus the bank termed as unstable. Banks estimated unstable are further divided into two types on the basis of the significance of the (negative) value of NPL/advance minus its equity/advance during a year. The value of NPL/advance minus its equity/advance is significant if it is less than the average (average of values of all banks during a year) by more than one standard deviation. In this study the values of NPL/advance and equity/advance are taken in ratio form and therefore 0.01 has been taken equal to one standard deviation.

Citibank and Deutsche bank are assessed stable throughout sample period, followed by National Bank, Standard Chartered Bank and First Women Bank. These three banks are appraised stable for 16 (out of 18) years (Table 4.13). Habib Bank, Habib Metropolitan Bank, Soneri Bank and Bank of Khyber are adjudged to have performed well in terms of stability during sample period. KASB Bank and Bank of Punjab are assessed unstable since 2007 and 2008 respectively, a result confirming the ground situation of these banks. The results also suggest that Askari Bank and Faysal Bank are financially less stable as against the common perception about it. Eight Pakistani commercial banks are considered unstable during 1998 - 2000. On the positive side, 13 out of 18 sample commercial banks are estimated financially stable especially after 2006 till 2014. Out of four unstable banks, KASB Bank has been merged with Bank Islami, thus reducing the number of unstable banks to three.

TABLE 4.13: Stability Assessment of Banks 1998-2014 (Pakistan).

Bank	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
KASB Bank	0.15	0.07	0.01	0.21	1.28	0.26	0.14	0.08	0.05	-0.03	-0.00	-0.11	-0.20	-0.07	-0.10	-0.15	-0.26
CitiBank	0.02	0.06	0.09	0.15	0.16	0.17	0.11	0.15	0.10	0.10	0.16	0.19	0.23	0.26	0.17	0.30	0.19
Deutsche Bank	0.03	0.07	0.08	0.12	0.31	0.72	0.58	1.15	0.63	0.63	0.65	1.27	1.31	1.67	1.25	1.03	0.69
National Bank	0.01	0.01	0.00	0.03	0.06	0.05	-0.00	0.19	0.07	0.07	0.03	0.05	0.05	0.01	0.01	0.06	0.03
Habib Bank	-0.10	-0.21	-0.19	-0.12	-0.13	-0.04	-0.03	0.05	0.05	0.04	0.06	0.06	0.04	0.07	0.10	0.10	0.15
United Bank	-0.04	-0.22	-0.23	-0.20	-0.06	0.04	0.01	0.03	0.05	0.05	0.04	0.06	0.03	0.05	0.09	0.08	0.11
MCB Bank	-0.04	-0.01	-0.08	-0.01	-0.01	0.03	0.03	0.11	0.15	0.16	0.15	0.20	0.14	0.21	0.24	0.27	0.28
Allied Bank	-0.12	-0.09	-0.12	-0.26	-0.38	-0.36	-0.11	-0.01	0.02	0.03	0.02	0.02	0.02	0.05	0.06	0.09	0.19
Bank Alfalah	-0.09	0.02	-0.02	0.04	0.01	0.01	-0.00	0.04	0.04	0.04	0.02	0.04	-0.04	-0.01	0.00	-0.00	0.05
Bank AlHabib	0.02	-0.05	-0.02	0.04	-0.01	0.00	0.05	0.09	0.05	0.06	0.05	0.06	0.03	0.07	0.08	0.07	0.11
Standard Chartered	0.02	-0.06	0.07	0.05	0.05	0.09	0.07	0.17	0.23	0.27	0.28	0.17	0.13	0.18	0.15	0.16	0.29
Askari Bank	0.00	0.07	0.03	0.06	0.01	0.09	0.06	0.08	0.06	0.06	0.00	-0.01	-0.07	-0.05	-0.03	-0.08	-0.05
Faysal Bank	0.01	0.09	0.18	0.09	0.15	0.21	0.10	0.21	0.07	0.06	0.04	0.01	-0.04	-0.06	-0.04	-0.04	-0.01
Habib Metropolitan	-0.02	-0.05	0.02	0.09	0.04	0.04	0.09	0.14	0.10	0.11	0.10	0.11	0.05	0.10	0.08	0.04	0.10
Bank of Punjab	0.04	0.01	0.10	0.32	0.37	0.20	0.14	0.21	0.06	0.06	-0.05	-0.30	-0.36	-0.45	-0.42	-0.34	-0.19
Soneri Bank	-0.12	-0.12	-0.00	0.08	0.08	0.06	0.05	0.14	0.12	0.12	0.08	0.04	-0.01	0.01	0.03	0.01	0.03
Bank of Khyber	-0.00	-0.05	-0.05	0.04	0.13	0.25	0.14	0.11	0.04	0.20	0.20	0.11	-0.04	0.19	0.21	0.16	0.22
1 st Women Bank	0.14	-0.03	0.09	0.35	0.64	0.42	0.29	0.27	0.25	0.30	0.30	0.23	0.06	0.11	0.14	0.09	0.16
Standard Deviation	0.07	0.09	0.11	0.15	0.35	0.22	0.15	0.25	0.14	0.15	0.16	0.31	0.33	0.41	0.32	0.27	0.20
Number of unstable Banks	8	10	8	4	5	2	4	1	0	1	2	3	7	5	4	5	4

In Table 4.14, the blank space means that the bank has been estimated as stable during the year under consideration, which means that NPL/advance estimated for a bank has been less than its equity advance during the year being reviewed. A bank assessed as unstable during a year has either been marked 'x' or 's' on the basis of significance of the value of a bank's estimated NPL/advance minus its equity/advance during that year. The value of NPL/advance minus its equity/advance is significant if it is less than the average (average of values of all banks during a year) by more than one standard deviation and marked 's'. Mark 'x' means that although the estimated NPL/advance of a bank has exceeded its equity/advance during that year but not by a significant margin i.e. by less than one standard deviation.

The values of NPL/advance minus equity/advance of KASB Bank and Bank of Punjab are negative and significant during 2014 and 2009-2012 respectively and confirm the ground situation experienced by these banks during that time period. The negative values of NPL/advance minus equity/advance of Habib Bank, United Bank and Allied Bank are significant during 1998-2000, 1999-2001 and 1998-2004 respectively. Habib Bank was controlling 18% assets of the whole financial sector during 1998-2003, United Bank was in possession of 9% assets while Allied bank was owner of 6% assets during 1998-2004. The three banks were collectively in control of 35% assets of the whole financial sector and thus big banks. These big banks were unstable during 1998-2001 and mainly responsible for the instability of the whole banking sector of Pakistan during that period.

TABLE 4.14: Results of Stability Assessment of Banks 1998-2014 (Pakistan).

Bank	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
KASB Bank										x	x	x	x	x	x	x	s
CitiBank																	
Deutsche Bank																	
National Bank							x										
Habib Bank	s	s	s	x	x	x	x										
United Bank	x	s	s	s	x												
MCB Bank	x	x	x	x	x												
Allied Bank	s	x	s	s	s	s	x	x									
Bank Alfalah	s		x				x						x	x		x	
Bank AlHabib		x	x		x												
Standard Chartered		x															
Askari Bank												x	x	x	x	x	x
Faysal Bank													x	x	x	x	x
Habib Metropolitan	x	x															

4.2.5 Stability Assessment of Overall Banking System 1998-2014

The empirical model developed is used to evaluate the stability of whole banking sector during sample period 1998-2014.

Literature review does not provide any insight to term a banking system stable or unstable on the basis of assets controlled by unstable banks. Therefore for this purpose, a new operational definition is developed in this study. Banking sector is termed unstable, less stable or stable during a year if total assets of all banks assessed as unstable are respectively more than 20%, 10-20% or less than 10% of total assets of all the sample banks.

When we analyze the banks on the basis of negative values of a bank's estimated NPL/advance minus equity/advance, the results (Table 4.15) suggest that Pakistan's banking system remained unstable during 1998-2004 but achieved stability during 2005-2009. The system turned unstable in 2010, but improved and as per our defined terms, is 'less stable' since 2010. In terms of percent assets of unstable banks, the stability of Pakistani banking system was grim during 1998-2002, when banks possessing 40-50% assets of banking system were unstable. The situation improved till 2006. There was no unstable bank during 2006. The stability condition however deteriorated after 2006. During 2010, banks holding more than 20% assets of banking system turned unstable. In 2011 and onward, as per our defined terms, the system is less stable i.e. total assets in control of unstable banks are 10-20% of the total assets of all sample banks. Another insight provided by the results is that (except the year 1999) the period of 1998-2004, during which the banking system has been estimated as unstable, %age assets of unstable banks were greater than %age number of unstable banks. The situation is other way round after the year 2004. During 2005-2014 the %age assets of unstable banks are markedly less than %age number of unstable banks. It means that during this period 1998-2004, big banks were unstable. After 2004 big banks are stable and small banks are experiencing financial hardships. Detail of the banks estimated

stable or unstable on the basis of negative values of a bank's estimated NPL/advance minus equity/advance is given in Table 4.13. During 1999-2004, big banks like Habib Bank, Muslim Commercial Bank, Allied Bank and United Bank are evaluated unstable. After 2004, these banks are assessed to improve its financial health and small banks like KASB, Bank of Punjab, Askari and Faysal Banks adjudged experiencing financial difficulty.

When we analyze the stability of a bank (and banking system) on the basis of only 'significant' values of the estimated NPL/advance minus equity/advance, then Pakistani commercial banks and overall banking system presents a different picture. During 1998-2000, the banking system is assessed unstable. During this period, minimum three and maximum four banks controlling 33-45% assets of the whole banking system are significantly unstable. During 2001, two banks possessing 18% assets of the banking system are significantly unstable. The banking system is thus assessed less stable during 2001. The system is appraised as stable during 2002-2014. During 2002-2003 only one bank (Allied) controlling 6% assets of the whole banking system is significantly unstable. No bank is significantly unstable during 2004-2008. Bank of Punjab controlling 4% assets of the whole banking system is significantly unstable during 2009-2012. After that only KASB Bank Limited (with 0.7% assets of the banking system) is unstable during 2014.

TABLE 4.15: Results of Stability Assessment of Banks 1998-2014 (Pakistan).

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of stable banks	10	8	10	14	13	16	14	17	18	17	16	15	11	13	14	13	14
Number of unstable banks	8	10	8	4	5	2	4	1	0	1	2	3	7	5	4	5	4
Number of unstable banks as %age of all banks	44	56	44	22	28	11	22	6	0	6	11	17	39	28	22	28	22
%age assets of unstable banks	46	49	50	40	44	22	44	5	0	1	4	8	20	18	11	17	11
Status of stability of banking system	Unstable							Stable					Unstable	Less stable			
Number of banks unstable by significant margin	4	3	3	2	1	1	0	0	0	0	0	1	1	1	1	0	1
%age assets of significantly unstable banks	33	36	45	18	6	6	0	0	0	0	0	3	4	4	5	0	0.7
Status of stability of banking system	Unstable		Less stable		Stable												

4.2.6 Stress Testing of Stability of Banks

Using empirical model, stress testing of all the sample banks is carried out, under various scenarios developed on the basis of extreme values of significant macroeconomic indicators during sample period. The purpose of stress test is to scrutinize each sample bank's tenacity for retaining its stability under normal, bad and worst economic conditions. Average and worst values of macroeconomic indicators (MEI) during sample period are used for normal (scenario 1) and worst (scenario 3) economic conditions respectively. For bad economic conditions (scenario 2) mean values of average (scenario 1) and worst values (scenario 3) were used. Mean values (mean of values during sample period) of bank specific factors and industry specific indicators are used for all scenarios. In any scenario, a bank is considered unstable during a year if its estimated NPL/advance exceeds its equity/advance during that year. Results for various scenarios are given in Table 4.16-4.21.

4.2.6.1 Stress Testing of Banks-Normal Economic Conditions (Scenario 1)

Results of normal economic conditions based on the values of a bank's estimated NPL/advance minus equity/advance are reported in Table 4.16. Negative sign of a value means that the estimated value of NPL/advance of the bank has surpassed the value of its equity/advance during the year under review. The results suggest that in normal economic conditions, the estimated NPL/advance of KASB Bank, Bank of Punjab, Askari Bank and Faysal Bank surpasses its equity advance values during 2010-2014. Similarly Habib Bank Limited, United Bank Limited, Allied Bank Limited, MCB Bank, Bank Al-Falah, Bank Al-Habib, Standard Chartered Bank, Habib Metropolitan Bank, Bank of Khyber, Soneri Bank and First Women Bank Limited are estimated unstable during 1998-2001. It is worth noting that the six biggest banks i.e. Habib Bank Limited, National Bank Limited, United Bank Limited, Muslim Commercial Bank Limited, Allied Bank Limited and Bank Al-Falah, controlling 70% of the assets of banking system, are assessed stable after 2005.

TABLE 4.16: Stress Testing of Banks-Normal Economic Conditions (Scenario 1)-Pakistan.

Bank	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
KASB Bank	0.13	0.07	0.01	0.20	1.30	0.23	0.12	0.04	0.04	-0.03	0.01	-0.09	-0.16	-0.04	-0.10	-0.14	-0.26
CitiBank	0.05	0.06	0.10	0.12	0.19	0.13	0.09	0.11	0.09	0.09	0.17	0.21	0.27	0.28	0.17	0.31	0.19
Deutsche Bank	0.06	0.06	0.08	0.09	0.34	0.69	0.56	1.11	0.62	0.62	0.66	1.28	1.34	1.69	1.25	1.04	0.69
National Bank	0.03	-0.01	0.01	0.01	0.08	0.02	-0.02	0.15	0.06	0.07	0.04	0.06	0.09	0.04	0.02	0.07	0.02
Habib Bank	-0.07	-0.22	-0.19	-0.15	-0.10	-0.07	-0.05	0.01	0.04	0.03	0.07	0.08	0.08	0.09	0.10	0.11	0.15
United Bank	0.02	-0.24	-0.23	-0.23	-0.03	0.01	-0.01	-0.00	0.04	0.05	0.04	0.07	0.07	0.07	0.09	0.09	0.11
MCB Bank	-0.02	-0.03	-0.08	-0.03	0.01	-0.00	0.02	0.07	0.14	0.16	0.15	0.21	0.17	0.24	0.24	0.27	0.28
Allied Bank	-0.09	-0.11	-0.12	-0.29	-0.33	-0.37	-0.13	-0.05	0.01	0.02	0.03	0.04	0.05	0.07	0.06	0.10	0.18
Bank Alfalah	-0.06	0.01	-0.02	0.01	0.03	-0.02	-0.02	0.00	0.03	0.03	0.02	0.05	-0.01	0.02	0.00	0.00	0.05
Bank AlHabib	0.05	-0.07	-0.02	0.01	0.01	-0.03	0.03	0.05	0.04	0.05	0.05	0.07	0.06	0.09	0.08	0.08	0.11
Standard Chartered	0.05	-0.08	0.07	0.02	0.07	0.06	0.05	0.13	0.22	0.27	0.29	0.19	0.17	0.20	0.16	0.17	0.29
Askari Bank	0.03	0.06	0.03	0.03	0.04	0.06	0.04	0.05	0.05	0.05	0.01	-0.00	-0.03	-0.03	-0.03	-0.07	-0.05
Faysal Bank	0.03	0.08	0.18	0.06	0.18	0.17	0.08	0.17	0.06	0.05	0.05	0.02	-0.01	-0.04	-0.04	-0.03	-0.01
Habib Metropolitan	0.00	-0.07	0.02	0.06	0.06	0.00	0.07	0.10	0.09	0.11	0.10	0.13	0.08	0.12	0.08	0.05	0.10
Bank of Punjab	0.07	0.00	0.10	0.30	0.39	0.16	0.12	0.17	0.05	0.06	-0.04	-0.29	-0.31	-0.43	-0.42	-0.33	-0.19
Soneri Bank	-0.09	-0.13	0.00	0.06	0.10	0.02	0.04	0.10	0.11	0.12	0.09	0.05	0.03	0.04	0.03	0.01	0.03
Bank of Khyber	0.03	-0.06	-0.05	0.01	0.16	0.21	0.12	0.07	0.03	0.20	0.21	0.13	-0.00	0.21	0.21	0.17	0.21
1st Women Bank	0.17	-0.05	0.09	0.33	0.67	0.38	0.27	0.24	0.24	0.30	0.31	0.24	0.10	0.14	0.14	0.09	0.16
Standard Deviation	0.07	0.09	0.10	0.16	0.35	0.22	0.15	0.25	0.14	0.15	0.16	0.31	0.33	0.41	0.32	0.27	0.20
Number of unstable banks	5	11	7	4	3	5	5	2	0	1	1	3	6	4	4	4	4

TABLE 4.17: Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-Scenario 1 (Pakistan).

Bank	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
KASB Bank										x		x	X	X	x	x	S
CitiBank																	
Deutsche Bank																	
National Bank		x					x										
Habib Bank	X	s	s	x	x	x	x										
United Bank		x	x	x	x		x	x									
MCB Bank	X	x	x	x		x											
Allied Bank	S	s	s	s	x	s	x	x									
Bank Alfalah	X		x			x	x						X				
Bank AlHabib		x	x			x											
Standard Chartered																	
Askari Bank													X	X	x	x	X
Faysal Bank													X	X	x	x	X
Habib Metropolitan		x															
Bank of Punjab		x									x	x	X	S	s	s	X
Soneri Bank	S	s															
Bank of Khyber		x	x										X				
First Women Bank		x															
Total number of unstable banks	5	11	7	4	3	5	5	2	0	1	1	3	6	4	4	4	4
Number of banks unstable by significant margin	2	3	2	1	0	1	0	0	0	0	0	0	0	1	1	1	1

Table 4.17 reports the result of banks in terms of the significance of the estimated NPL/advance minus equity/advance value. A bank assessed as unstable during a year has either been marked 'x' or 's' on the basis of significance of the value of a bank's estimated NPL/advance minus its equity/advance during that year. Blank space means that the value of a bank's estimated NPL/advance minus its equity/advance during that year is positive and the bank assessed stable.

In normal economic conditions, 1999 is adjudged as the toughest year with 11 banks (out of 18) assessed unstable. Out of these 11 unstable banks, 3 banks are estimated significantly unstable. Out of these 3 significantly unstable banks, 2 are big banks i.e. Habib Bank and Allied Bank. Allied Bank is assessed significantly unstable during 1998-2001 and then during 2004. Allied Bank and Habib Bank have however, been assessed stable during 2006 and onward. Soneri Bank has been evaluated as significantly unstable during 1998 - 1999. An interesting conclusion of the analysis is that that all those banks which are assessed unstable during the period 1998-2005, are evaluated stable during 2006 and onward, while the four banks i.e. KASB Bank, Askari Bank, Faysal Bank and Bank of Punjab, which are adjudged stable till 2006 lost stability during 2009 and onward. CitiBank, Deutsche Bank and Standard Chartered Bank are the 3 banks evaluated stable throughout the years being reviewed.

4.2.6.2 Stress Testing of Banks-Bad Economic Conditions (Scenario 2)

Table 4.18 reports the results of stress testing in bad economic conditions based on the values of a bank's estimated NPL/advance minus equity/advance. In bad economic condition, six banks i.e. National Bank, Soneri Bank, KASB Bank, Askari Bank, Faysal Bank and Bank of Punjab are assessed unstable during 2012 and 2013. Bank Al-Falah is evaluated to lose stability in bad economic conditions in all sample years except during 2009 and 2014. Standard Chartered Bank is also evaluated unable to withstand bad economic conditions during 1999 and 2001.

TABLE 4.18: Stress Testing of Banks-Bad Economic Conditions (Scenario 2)-Pakistan.

Bank	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
KASB Bank	0.09	0.03	-0.03	0.16	1.26	0.19	0.09	0.00	0.00	-0.07	-0.03	-0.13	-0.20	-0.08	-0.14	-0.18	-0.30
CitiBank	0.01	0.02	0.06	0.08	0.15	0.10	0.05	0.07	0.05	0.06	0.13	0.17	0.23	0.24	0.13	0.27	0.15
Deutsche Bank	0.02	0.02	0.04	0.05	0.30	0.65	0.52	1.07	0.58	0.58	0.62	1.24	1.30	1.65	1.21	1.00	0.65
National Bank	-0.00	-0.05	-0.03	-0.03	0.04	-0.02	-0.06	0.11	0.02	0.03	0.00	0.02	0.05	-0.00	-0.02	0.03	-0.01
Habib Bank	-0.11	-0.26	-0.23	-0.19	-0.14	-0.11	-0.08	-0.03	0.00	-0.00	0.03	0.04	0.04	0.05	0.06	0.07	0.11
United Bank	-0.02	-0.28	-0.27	-0.27	-0.07	-0.03	-0.04	-0.04	0.00	0.01	0.01	0.03	0.03	0.03	0.05	0.05	0.07
MCB Bank	-0.05	-0.07	-0.11	-0.07	-0.03	-0.04	-0.02	0.04	0.10	0.12	0.11	0.17	0.13	0.20	0.20	0.23	0.24
Allied Bank	-0.13	-0.15	-0.16	-0.33	-0.37	-0.41	-0.17	-0.09	-0.03	-0.01	-0.01	-0.00	0.01	0.03	0.03	0.06	0.15
Bank Alfalah	-0.10	-0.03	-0.06	-0.03	-0.01	-0.06	-0.06	-0.04	-0.01	-0.00	-0.02	0.01	-0.05	-0.02	-0.03	-0.04	0.01
Bank AlHabib	0.01	-0.11	-0.06	-0.03	-0.03	-0.07	-0.01	0.01	0.00	0.02	0.01	0.03	0.02	0.05	0.04	0.04	0.07
Standard Chartered	0.01	-0.11	0.03	-0.02	0.03	0.02	0.01	0.09	0.18	0.23	0.25	0.15	0.13	0.16	0.12	0.13	0.25
Askari Bank	-0.01	0.02	-0.01	-0.01	0.00	0.02	0.01	0.01	0.01	0.01	-0.03	-0.04	-0.07	-0.07	-0.07	-0.11	-0.09
Faysal Bank	-0.01	0.04	0.14	0.03	0.14	0.14	0.04	0.14	0.02	0.01	0.01	-0.02	-0.04	-0.08	-0.08	-0.07	-0.05
Habib Metropolitan	-0.04	-0.11	-0.02	0.02	-0.02	0.03	0.04	0.06	0.06	0.07	0.06	0.09	0.04	0.08	0.04	0.01	0.06
Bank of Punjab	0.03	-0.04	0.07	0.26	0.35	0.12	0.09	0.13	0.01	0.02	-0.08	-0.33	-0.35	-0.47	-0.46	-0.37	-0.23
Soneri Bank	-0.13	-0.17	-0.04	0.02	0.06	-0.02	-0.00	0.06	0.07	0.08	0.05	0.01	-0.01	-0.00	-0.01	-0.02	-0.01
Bank of Khyber	-0.01	-0.10	-0.09	-0.02	0.12	0.18	0.08	0.03	-0.01	0.16	0.17	0.09	-0.04	0.17	0.17	0.13	0.18
1st Women Bank	0.13	-0.09	0.06	0.29	0.63	0.34	0.24	0.20	0.20	0.26	0.27	0.21	0.06	0.10	0.10	0.05	0.12
Standard Deviation	0.07	0.09	0.10	0.16	0.35	0.22	0.15	0.25	0.14	0.15	0.16	0.31	0.33	0.41	0.32	0.27	0.20
Number of unstable banks	11	13	12	10	7	8	8	4	3	4	5	5	7	7	7	6	6

In bad economic conditions, the NPL/advance of banks assessed unstable in terms of the significance of the negative value of estimated NPL/advance minus equity/advance, is analyzed in Table 4.19. A maximum of eight banks are assessed significantly unstable during 1999. These banks include some big banks like Habib Bank, United Bank, Allied Bank and Bank Al-Habib. Three banks each are evaluated significantly unstable in bad economic conditions during 1998, 2000 and 2001. After 2001, maximum number of banks assessed unstable by significant margin is one till 2013. During 2014, two banks i.e. KASB and Bank of Punjab are appraised significantly unstable and unable to withstand bad economic conditions.

4.2.6.3 Stress Testing of Banks-Worst Economic Conditions (Scenario 3)

To assess robustness of the bank, stress testing is carried out for its performance in worst economic conditions also. As discussed above, worst economic conditions mean the worst values of macroeconomic indicators during the sample period (with mean values of bank specific and industry specific indicators).

Results of stress testing of banks in worst economic conditions (scenario 3) based on the values of a bank's estimated NPL/advance minus equity/advance are reported in Table 4.20. Almost all the commercial banks of Pakistan except two, Bank of Punjab and First Women bank, are assessed unable to withstand worst economic conditions, during the period 1998-2006. It is interesting to note that Bank of Punjab which is continuously unstable since 2007 is evaluated to exhibit robustness to withstand even the worst economic conditions during 2000-2005. First Women Bank is the only bank, able to remain financially stable in all economic conditions throughout the period 2000-2014. It is interesting to note that when almost all commercial banks have been assessed unstable during 1998, KASB Bank is assessed stable during 1998 and then continuously unstable till 2014.

TABLE 4.19: Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-(Scenario 2)-Pakistan.

Bank	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
KASB Bank			x							x	x	x	x	X	x	x	S
CitiBank																	
Deutsche Bank																	
National Bank	X	x	x	x		x	x							X	x		
Habib Bank	S	s	s	s	x	x	x	x		x							
United Bank	X	s	s	s	x	x	x	x									
MCB Bank	X	x	x	x	x	x	x										
Allied Bank	S	s	s	s	s	s	s	x	x	x	x	x					
Bank Alfalah	X	x	x	x	x	x	x	x	x	x	x		x	X	x	x	
Bank AlHabib		s	x	x	x	x	x										
Standard Chartered		s		x													
Askari Bank	X		x	x							x	x	x	X	x	x	X
Faysal Bank	X											x	x	X	x	x	X
Habib Metropolitan	X	s	x		x												
Bank of Punjab		x									x	s	s	S	s	s	S
Soneri Bank	S	s	x			x	x						x	X	x	x	X
Bank of Khyber	X	s	x	x					x				x				
First Women Bank		x															
Total number of unstable banks	3	8	3	3	1	1	1	0	0	0	0	1	1	1	1	1	2
Number of banks unstable by significant margin	11	13	12	10	7	8	8	4	3	4	5	5	7	7	7	6	6

TABLE 4.20: Stress Testing of Banks-Worst Economic Conditions (Scenario 3)-Pakistan.

Bank	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
KASB Bank	0.05	-0.01	-0.07	0.12	1.22	0.15	0.05	-0.03	-0.04	-0.11	-0.07	-0.17	-0.24	-0.12	-0.18	-0.22	-0.34
CitiBank	-0.03	-0.02	0.02	0.04	0.11	0.06	0.01	0.03	0.01	0.02	0.09	0.13	0.19	0.20	0.10	0.23	0.11
Deutsche Bank	-0.02	-0.02	0.00	0.01	0.26	0.61	0.48	1.04	0.54	0.55	0.58	1.20	1.26	1.61	1.17	0.96	0.61
National Bank	-0.04	-0.09	-0.07	-0.07	-0.00	-0.06	-0.10	0.07	-0.02	-0.01	-0.04	-0.02	0.01	-0.04	-0.06	-0.01	-0.05
Habib Bank	-0.15	-0.30	-0.27	-0.22	-0.18	-0.15	-0.12	-0.06	-0.04	-0.04	-0.01	0.00	0.00	0.02	0.02	0.03	0.07
United Bank	-0.06	-0.32	-0.31	-0.31	-0.11	-0.07	-0.08	-0.08	-0.04	-0.03	-0.03	-0.01	-0.01	0.00	0.01	0.01	0.03
MCB Bank	-0.09	-0.11	-0.15	-0.11	-0.07	-0.08	-0.06	0.00	0.06	0.08	0.08	0.13	0.10	0.16	0.16	0.20	0.20
Allied Bank	-0.17	-0.19	-0.20	-0.37	-0.41	-0.45	-0.21	-0.13	-0.06	-0.05	-0.05	-0.04	-0.03	0.00	-0.01	0.02	0.11
Bank Alfalah	-0.14	-0.07	-0.09	-0.07	-0.05	-0.10	-0.10	-0.08	-0.05	-0.04	-0.05	-0.03	-0.09	-0.06	-0.07	-0.07	-0.03
Bank AlHabib	-0.03	-0.15	-0.10	-0.07	-0.06	-0.11	-0.04	-0.03	-0.04	-0.02	-0.02	-0.01	-0.01	0.02	0.00	0.00	0.03
Standard Chartered	-0.02	-0.15	-0.01	-0.06	-0.01	-0.02	-0.03	0.06	0.14	0.19	0.21	0.11	0.09	0.12	0.08	0.09	0.21
Askari Bank	-0.05	-0.02	-0.05	-0.05	-0.04	-0.02	-0.03	-0.03	-0.03	-0.03	-0.07	-0.08	-0.11	-0.11	-0.11	-0.15	-0.13
Faysal Bank	-0.04	0.00	0.10	-0.01	-0.10	-0.10	0.01	0.10	-0.02	-0.02	-0.03	-0.06	-0.08	-0.12	-0.12	-0.11	-0.09
Habib Metropolitan	-0.07	-0.15	-0.06	-0.02	-0.01	-0.07	0.00	0.02	0.02	0.03	0.03	0.05	0.01	0.04	0.00	-0.03	0.02
Bank of Punjab	-0.01	-0.08	0.03	0.22	0.31	0.08	0.05	0.09	-0.03	-0.02	-0.12	-0.37	-0.39	-0.51	-0.50	-0.41	-0.27
Soneri Bank	-0.17	-0.21	-0.08	-0.02	0.02	-0.05	-0.04	0.02	0.03	0.04	0.01	-0.03	-0.05	-0.04	-0.05	-0.06	-0.05
Bank of Khyber	-0.05	-0.14	-0.13	-0.06	0.08	0.14	0.04	-0.01	-0.05	0.12	0.13	0.05	-0.08	0.13	0.13	0.09	0.14
1st Women Bank	0.09	-0.12	0.02	0.25	0.59	0.30	0.20	0.16	0.16	0.22	0.23	0.17	0.02	0.06	0.06	0.02	0.08
Standard Deviation	0.07	0.09	0.10	0.16	0.35	0.22	0.15	0.25	0.14	0.15	0.16	0.31	0.33	0.41	0.32	0.27	0.20
Number of unstable banks	16	17	13	13	11	12	11	9	10	10	10	11	10	8	8	7	6

In worst economic conditions, results of the stability of banks in terms of the significance of the negative value of estimated NPL/advance minus equity/advance are reported in Table 4.21. The period 1998-2001 is assessed to be the worst period for Pakistani banking sector. Almost all domestic banks are assessed unable to withstand macroeconomic shocks. The six biggest banks i.e. Habib Bank, National Bank, United Bank, MCB Bank, Allied Bank and Bank Al-Falah, controlling 70% of the assets of banking system, are assessed significantly unstable and unable to withstand worst economic conditions during 1998-2001. For the period 2005-2014, two banks i.e. KASB and Bank of Punjab have been evaluated significantly unstable i.e its estimated NPL/advance surpassing its equity/advance by a significant margin. KASB bank has been evaluated markedly unstable during 2014 while the Bank of Punjab appraised unstable for the period 2009-2014. Interestingly except 1st Women Bank, these two banks are the only domestic commercial banks assessed to withstand even worst economic conditions at the start of sample period i.e. KASB bank during 1998 and bank of Punjab during 2000-2005.

4.2.7 Stress Testing of Stability of Overall Banking System

Using the results related to the stability of commercial banks reported in Table 4.17-4.21, stability of whole banking sector is determined in all the sample years under various scenarios. Banking sector is termed unstable, less stable or stable during a year if total assets of all banks assessed as unstable are respectively more than 20%, 10-20% or less than 10% of total assets of all the sample banks.

Three scenarios are developed for stress testing. Scenario 1 represent normal economic condition using average values of macroeconomic indicators during sample period. Scenario 3 represents worst economic condition and is represented by the worst values of macroeconomic indicators (MEI) during sample period. Scenario 2 is developed for bad economic condition and represents conditions between normal and worst economic conditions. Mean of the average and worst values of macroeconomic indicators during sample period are used to surrogate bad economic conditions.

TABLE 4.21: Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-(Scenario 3)-Pakistan.

Bank	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
KASB Bank		x	x	x				x	x	X	x	x	x	X	x	x	s
CitiBank	X	x															
Deutsche Bank	X	x															
National Bank	X	x	x	x	X	X	X		x	X	x	x		X	x	x	x
Habib Bank	S	s	s	s	X	X	X	x	x	X	x	x					
United Bank	X	s	s	s	X	X	X	x	x	X	x	x	x	X			
MCB Bank	S	s	s	x	X	X	X	x									
Allied Bank	S	s	s	s	S	S	S	x	x	X	x	x	x	X	x		
Bank Alfalah	S	x	x	x	X	X	X	x	x	X	x	x	x	X	x	x	x
Bank AlHabib	X	s	x	x	X	X	X	x	x	X	x	x	x				
Standard Chartered	X	s	x	x	X	X	X										
Askari Bank	X	x	x	x	X	X	X	x	x	X	x	x	x	X	x	x	x
Faysal Bank	X	x	x	x	X	X	X	x	x	x	x	x	x	X	x	x	x
Habib Metropolitan	X	s	x	x	X	X									x	x	
Bank of Punjab	X	x							x	x	x	s	s	S	s	s	s
Soneri Bank	S	s	x	x		X	X					x	x	X	x	x	x
Bank of Khyber	X	s	s	x					X			x	x				
First Women Bank		s															
Total number of unstable banks by significant margin	5	10	5	3	1	1	1	0	0	0	0	1	1	1	1	1	2
Number of banks unstable	16	17	13	13	11	12	11	9	11	10	10	11	10	9	8	8	7

4.2.7.1 Stress Testing of Stability of Banking System in Normal Economic Conditions-Scenario 1

Average values of macroeconomic indicators (MEI) during sample period are used to represent normal economic conditions (scenario 1). Results of stress testing for normal economic conditions in terms of the value of estimated NPL/advance minus equity/advance, are appended in Table 4.22.

In scenario 1 situation (Table 4.22), the banking system of Pakistan has been assessed unstable during 1998-2004 (assets of unstable banks more than 20 per cent). The system is appraised less stable in 2005 and stable during 2006-2009. The banking system is however assessed not to retain its stability during 2010-2014 and turn less stable (assets of unstable banks more than 10 per cent). As a whole, the banking system of Pakistan is adjudged to have demonstrated a positive trend. Banking system is assessed 'unstable' during 1998 -2004, which improved to 'less stable' position in 2005 and attained the state of stability during 2006-2009. Banking system is assessed 'less stable' during 200 -2014. However, a close look of the results indicates that the system has shown a positive trend during this period also.

As per our operational definition, banking system is considered stable if banks assessed unstable are in possession of less than 10 percent of the assets of whole banking system. During the last four years i.e. 2011-2014, unstable banks are in possession of 11-12 percent assets of the banking system and therefore on the border line of stability. Another trend the data purports is that during the period 1998-2005, assets of unstable banks (as %age of all banks) are greater than the number of unstable banks as %age of all banks. After 2006, the situation is other way round i.e. assets of unstable banks (as %age of all banks) is less than the number of unstable banks as %age of all banks. This means that during the period 1998-2005, bigger banks were unstable while after 2006 the bigger banks have attained stability while smaller banks are experiencing financial challenges.

TABLE 4.22: Results of Stress Testing of Stability of Banking System-Scenario 1 (Pakistan).

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of unstable banks	5	11	7	4	3	5	5	2	0	1	1	3	6	4	4	4	4
Number of stable banks	13	7	11	14	15	13	13	16	18	17	17	15	12	14	14	14	14
Number of unstable banks as %age of all banks	28	61	39	22	17	28	28	11	0	6	6	17	33	22	22	22	22
%age assets of unstable banks	35	70	49	40	31	38	53	15	0	1	3	8	19	12	11	11	11
Status of stability of banking system	Unstable							Less stable	Stable				Less Stable				

TABLE 4.23: Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-Scenario 1 (Pakistan).

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of banks unstable by significant margin	2	3	2	1	0	1	0	0	0	0	0	0	0	1	1	1	1
%age assets of significantly unstable banks	8	33	35	6	0	6	0	0	0	0	0	0	0	4	4	4	0.7
Status of stability of banking system	Stable	Unstable		Stable													

Analyzing the stability of individual banks and banking system on the basis of 'significance' of the estimated NPL/advance minus equity/advance value, the results suggest that except 1999-2000, Pakistani banking system is evaluated to remain stable in normal economic conditions. During 1999-2000, two-three banks controlling 33-35% assets of the whole banking system are significantly unstable. During 2001 and 2003 only one bank (Allied Bank) controlling 6% assets of the whole banking system is evaluated significantly unstable. No bank is assessed significantly unstable during 2004 -2010. Bank of Punjab controlling 4% assets of the whole banking system is significantly unstable during 2011-2013. After that only KASB Bank (with 0.7% assets of the banking system) is assessed unstable during 2014.

4.2.7.2 Stress Testing of Stability of Banking System in Bad Economic Conditions-Scenario 2

Mean of the average and worst values of macroeconomic indicators during sample period are used to surrogate bad economic conditions. Results of stress testing for bad economic conditions (scenario-2) in terms of the value of estimated NPL/advance minus equity/advance, are appended in Table 4.24. In bad economic conditions, banking system of Pakistan is assessed as unstable during 1998-2005, less stable in 2006, unstable during 2007-8, less stable during 2009 and then unstable during 2010-14.

Stress testing results of the stability of individual banks (and banking system) on the basis of 'significance' of the estimated NPL/advance minus equity/advance values, are reported in Table 4.25. The results indicate that overall banking system is not capable to withstand bad economic conditions during 1998-2001. During 1998-2001, minimum 3 and maximum 8 banks controlling 32-50% assets of the whole banking system are assessed significantly unstable. During 2002 and onward, the banking system is appraised robust enough to withstand bad economic conditions.

TABLE 4.24: Results of Stress Testing of Stability of Banking System-Scenario 2 (Pakistan).

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of unstable Banks	11	13	12	10	7	8	8	4	3	4	5	5	7	7	7	6	6
Number of stable banks	7	5	6	8	11	10	10	14	15	14	13	13	11	11	11	12	12
Number of unstable banks as %age of all banks	61	72	67	56	39	44	44	22	17	22	28	28	39	39	39	39	33
%age assets of unstable banks	70	73	74	70	49	67	66	35	13	26	21	17	20	33	31	31	26
Status of stability of banking system	Unstable								Less stable	Unstable		Less Stable		Unstable			

TABLE 4.25: Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-Scenario 2 (Pakistan).

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of banks unstable by significant margin	3	8	3	3	1	1	1	0	0	0	0	1	1	1	1	1	2
%age assets of significantly unstable banks	32	50	45	45	6	6	6	0	0	0	0	4	4	4	4	4	4.7
Status of stability of banking system	Unstable					Stable											

During 2002-2004 only one bank (Allied Bank) controlling 6% assets of the whole banking system is significantly unstable. No bank is assessed significantly unstable during 2005-2008. Bank of Punjab controlling 4% assets of the whole banking system is significantly unstable during 2009-2013. During 2014, Bank of Punjab (with 4.0% assets of the banking system) and KASB Bank (with 0.7% assets of the banking system) are assessed unstable.

4.2.7.3 Stress Testing of Stability of Banking System in Worst Economic Conditions-Scenario 3

Worst values of macroeconomic indicators during sample period are used to surrogate worst economic conditions. Results of stress testing for worst economic conditions (scenario-3) are appended in Table 4.26. Results of our analysis based on the value of estimated NPL/advance minus equity/advance, indicate that during the period under review i.e. 1998-2014, banking system of Pakistan is assessed unable to withstand worst economic conditions.

Analyzing the stability of individual banks (and banking system) on the basis of 'significance' of the estimated NPL/advance minus equity/advance value; overall banking system is assessed financially stable during 2002 and onward even in worst economic conditions. During 1998-2001, minimum 3 and maximum 10 banks controlling 45-62% assets of the whole banking system are significantly unstable. During 2002-2004 only one bank (Allied Bank) controlling 6% assets of the whole banking system is evaluated significantly unstable. No bank is assessed significantly unstable during 2005-2008. Bank of Punjab controlling 4% assets of the whole banking system is significantly unstable during 2009-2014. During 2014, Bank of Punjab and KASB Bank (with 4.7% assets of the banking system) are assessed unstable.

TABLE 4.26: Results of Stress Testing of Stability of Banking System-Scenario 3 (Pakistan).

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of unstable Banks	16	17	13	13	11	12	11	9	11	10	10	11	10	9	9	8	7
Number of stable banks	2	1	5	5	7	6	7	9	7	8	8	7	8	9	9	10	11
Number of unstable banks as %age of all banks	89	94	72	72	61	67	61	50	56	56	56	61	56	44	44	39	33
%age assets of unstable banks	79	78	76	75	55	76	73	50	66	65	64	66	41	49	41	34	32
Status of stability of banking system	Unstable																

TABLE 4.27: Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-Scenario 3 (Pakistan).

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of banks unstable by significant margin	5	10	5	3	1	1	1	0	0	0	0	1	1	1	1	1	2
%age assets of significantly unstable banks	45	62	55	45	6	6	6	0	0	0	0	4	4	4	4	4	4.7
Status of stability of banking system	Unstable					Stable											

4.3 Results of the Study-India

4.3.1 Results of Diagnostic Tests

Diagnostic tests of the data are carried out. Results of descriptive statistics, multicollinearity test, Serial Correlation and Autocorrelation are reported in Table 4.28, 4.29 and 4.30.

Average capital adequacy ratio (CAR) of the commercial banks operating in India is 11.9%, with a maximum level of 19.6% (ICICI bank in 2000) and minimum level of 0% (by a number of banks) during various years of sample period 1999-2014. The variation observed in capital adequacy ratio during sample period is 2.8%. As evident from the results of Jarque-Bera test (679.1), the data of capital adequacy ratio is not normally distributed.

Results of descriptive statistic, discerns that average investment of the commercial banks operating in India in unapproved securities (Invunapprsec) remained 27%, with a maximum level of 96% (Central Bank of India in 2004) and minimum level of 1.8% (by Citibank during 2012). The variation observed in investment in unapproved securities during sample period is 2.8%. As evident from the results of skewness (1.89), kurtosis (5.99), Jarque-Bera test (264), the data of investment in unapproved securities is not normally distributed.

Average return on equity (ROE) of the sample commercial banks operating in India is 14.7%, having a maximum level of 31.8% (Axis bank limited in 2001) and minimum level of (-)12.7% (by Indian bank during 1999). The variation observed in return on equity during sample period is 2.8%. As evident from the results of Jarque-Bera test, the data of return on equity is normally distributed.

Results indicate that average interest rate (Intr) remained 6.68% in India, reaching a maximum level of 8.5% in 1999 and touching the minimum level of 4.75% during 2002. The variation observed in average interest rate during sample period is 1.02%. As evident from the results of skewness (-0.07), kurtosis (2.37), Jarque-Bera test (4.62), the data of average interest rate is normally distributed.

TABLE 4.28: Descriptive Statistic (India).

	NPL/Gross advances	Capital Ade- quacy Ratio (CAR)	Investment in unap- proved securities (Invunappr- sec)	Return on Equity (ROE)	Interest Rate (Intr)	Unemployment rate (UN- EMP)	Inflation (CPI)	Foreign direct in- vestment as percent of GDP (FDIGDP)
Mean	0.030718	0.119	0.273107	0.1474	0.0668	0.03934	0.0669	0.01222
Median	0.015605	0.119	0.20395	0.1588	0.0645	0.039	0.0614	0.01203
Maximum	0.1266	0.196	0.9626	0.3184	0.085	0.044	0.1199	0.01988
Minimum	0.0015	0	0.0185	-0.127	0.0475	0.0344	0.0368	0.00464
Std. Dev.	0.032655	0.028	0.207021	0.075	0.0102	0.0032	0.0278	0.00422
Skewness	1.410388	-1.54	1.892227	-0.577	-0.0719	0.10145	0.5177	-0.0004
Kurtosis	3.930546	10.09	5.996501	3.330	2.3773	1.55373	1.8081	1.99177
Jarque-Bera	99.99052	679.1	264.0793	16.34	4.6282	24.172	28.253	11.5206

Average unemployment rate (Unemp) remained 3.9%, reaching a maximum level of 4.4% in 1999 and then 2005) and minimum level of 3.44% during 2009 and then 2010. The variation observed in unemployment rate during sample period is 0.32%. As evident from the results of Jarque-Bera test (24.17), the data of unemployment rate is normally distributed.

Results of the test, indicate that during the period under review, average of consumer price index (CPI) remained 6.69%, reaching a maximum level of 10.99% (in 2013) and minimum level of 3.68% (during 2001). The variation observed in consumer price index during sample period is 2.78%. As evident from the results of skewness (0.51), kurtosis (1.8), Jarque-Bera test (28.2), the data of inflation represented by consumer price index is normally distributed.

Average foreign direct investment as percent of GDP (FDIGDP) was 1.22%, reaching a maximum level of 1.988% (in 2011) and minimum level of 0.46% during 1999. The variation observed in foreign direct investment as percent of GDP during sample period is 0.422%. As evident from the results of skewness (-0.0004), kurtosis (1.99) and Jarque-Bera test (11.5), the data of foreign direct investment as percent of GDP is normally distributed.

The data was tested for serial correlation, multicollinearity etcetera. Results of multicollinearity test are given in Table 4.29. Maximum value of variance inflation factor is 2.94 for FDI/GDP which is less than maximum acceptable limit of 5. Tolerance level is also high, which means that there is no significant multicollinearity issue in the data of regressors (O'Brien, 2007).

TABLE 4.29: Multicollinearity Test (India).

Variable	Rsqr	TOL	VIF
Capital Adequacy Ratio	0.250	0.750	1.333333
Investment in unapproved securities	0.460	0.540	1.851852
Return on Equity	0.308	0.692	1.445087
Interest Rate	0.133	0.867	1.153403
Inflation (CPI)	0.600	0.400	2.500000
Foreign direct investment as percent of GDP	0.661	0.340	2.941176
Unemployment rate	0.548	0.452	2.212389

Breusch-Godfrey Serial Correlation LM Test results are given in Table 4.30. Low value of F-statistic (0.1414) and high value of prob. Chi-Square 0.8611 ($.05$) indicate that null hypothesis of no serial correlation stands validated and that there is no serial correlation in the residual terms.

TABLE 4.30: Breusch-Godfrey Serial Correlation LM Test (India).

Test	Result
F-statistic	0.1414
Obs×R-squared	0.2991
Prob. F(2,294)	0.8682
Prob. Chi-Square(2)	0.8611

Results of Autoregressive Conditional Heteroskedasticity (ARCH) Test are given in Table 4.31. Low value of F-statistic (0.668) and high value of prob. Chi-Square (0.51) indicate that null of no homoskedasticity cannot be rejected and that the errors terms are homoskedestic.

TABLE 4.31: Autoregressive Conditional Heteroskedasticity (ARCH) Test (India).

Test	Result
F-statistic	0.668255
Obs×R-squared	1.344857
Prob. F(2,265)	0.5135
Prob. Chi-Square(2)	0.5105

4.3.2 Analysis of Results

Influence of bank specific factors, industry specific indicators and macroeconomic indicators was studied separately.

4.3.2.1 Impact of Bank Specific Variables on NPL

Results of the clout of bank specific factors on NPL/advance are reported in Table 4.32. Lag effect of NPL/advance has the most significant effect (t-stat = 15.92), followed by investment in unapproved securities and return on equity. As evident

from its adjusted R-squared value (0.775), bank specific factors are responsible for 77 percent variation in NPL ratio.

TABLE 4.32: Impact of Bank Specific Variables (India).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0378	0.0066	5.7562	0
Non-performing loans to gross advances(-1)	0.6890	0.0433	15.9228	0
Capital Adequacy Ratio	-0.2667	0.0417	-6.3898	0
Capital Adequacy Ratio(-1)	0.1344	0.0438	3.0700	0.0024
Investment in unapproved securities	0.0433	0.0065	6.6888	0
Investment in unapproved securities(-1)	-0.0351	0.0076	-4.6379	0
Investment in unapproved securities(-2)	-0.0199	0.0057	-3.4906	0.0006
Return on equity	-0.1160	0.0175	-6.6273	0
Return on equity(-1)	0.0528	0.0186	2.8318	0.005
R-squared	0.7757	F-statistic		112.82
Adjusted R-squared	0.768822	Prob(F-statistic)		0
Sum squared residuals	0.064704	Durbin-Watson stat		2.0071

4.3.2.2 Impact of Industry Specific Indicators on NPL

Result of the influence of interest rate, the only industry specific indicator being studied on NPL/advance is reported in Table 4.33. As evident from the value of adjusted R-squared, variation in interest rate explains only 1.7 per cent variation in ratio of non-performing loans of Indian commercial banks.

TABLE 4.33: Impact of Industry Specific Indicators (India).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.058	0.0120	-4.8296	0
Interest rate(-2)	1.3309	0.1778	7.4828	0
R-squared	0.1728	Log likelihood		566.1162
Adjusted R-squared	0.1697	F-statistic		55.9934
S.E. of regression	0.0298	Prob(F-statistic)		0
Sum squared residuals	0.2386	Durbin-Watson stat		20.7739

4.3.2.3 Impact of Bank Specific and Industry Specific Indicators on NPL

Table 4.34 reports the impact of bank specific and industry specific indicators on NPL ratio of Indian scheduled commercial banks. When interest rate is studied separately for its influence on NPL ratio, its explanatory power is 1.69 percent. Bank specific factors explain 76.88 percent variation in NPL ratio of commercial bank. However, whether studied alone or taken together for its influence on NPL ratio, there is no difference in the explanatory powers of industry specific and bank specific factors. The value of adjusted R-squared ascertains that bank specific and industry specific indicators explain 80.25 per cent variations in NPL ratio of Indian commercial banks.

TABLE 4.34: Impact of Bank Specific and Industry Specific Indicators on NPL (India).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.0115	0.0095	-1.2063	0.2288
Non-performing loans to gross advances(-1)	0.6360	0.0408	15.5897	0
Capital Adequacy Ratio	-0.2124	0.0394	-5.3889	0
Capital Adequacy Ratio(-1)	0.1295	0.0405	3.2009	0.0015
Investment in unapproved securities	0.0373	0.0060	6.1816	0
Investment in unapproved securities(-1)	-0.0213	0.0072	-2.9378	0.0036
Investment in unapproved securities(-2)	-0.0182	0.0053	-3.4506	0.0007
Return on equity	-0.1231	0.0162	-7.5907	0
Return on equity(-1)	0.0517	0.0173	2.9988	0.0030
Interest rate(-2)	0.6549	0.0970	6.7484	0
R-squared	0.8091	F-statistic		122.464
Adjusted R-squared	0.8025	Prob(F-statistic)		0
Sum squared residuals	0.0551	Durbin-Watson stat		2.0489

4.3.2.4 Impact of Macroeconomic Indicators on NPL

Results of the influence of macroeconomic indicators on NPL ratio is reported in Table 4.35. It may be noted that when the influence of only macroeconomic indicators is studied, only FDI/GDP and unemployment rate are having significant

influence on NPL ratio of Indian commercial banks. However, when lagged effect of NPL Ratio (lag 1), is added, inflation (CPI) also become statistically significant (Table 4.36).

TABLE 4.35: Impact of Macroeconomic Indicators on NPL (India).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.1466	0.0334	4.3858	0
Consumer price index(-2)	-0.0038	0.0678	-0.0561	0.9553
Unemployment rate	-1.3865	0.7105	-1.9513	0.0521
Foreign direct investment/GDP	-4.9783	0.5116	-9.7303	0
R-squared	0.3188	F-statistic		41.5143
Adjusted R-squared	0.3112	Prob(F-statistic)		0
Sum squared residuals	0.1964	Durbin-Watson stat		0.9728

TABLE 4.36: Impact of Macroeconomic Indicators and NPL (lag 1) on NPL Ratio (India).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.1021	0.0272	3.7494	0.0002
Non-performing loans to gross advances(-1)	0.5787	0.0483	11.9821	0.0000
Consumer price index(-2)	0.1538	0.0563	2.7335	0.0067
Unemployment rate	-1.5199	0.5734	-2.6507	0.0085
Foreign direct investment/GDP	-3.2307	0.4378	-7.3792	0.0000
R-squared	0.5582	F-statistic		483.7167
Adjusted R-squared	0.5515	Prob(F-statistic)		0
Sum squared residuals	0.1274	Durbin-Watson stat		1.7986

4.3.2.5 Lag Effect of NPL/Advance on Itself

Results of our empirical analysis (Table 4.32-4.36) discern that lag effect of NPL ratio on itself has the most significant and provides maximal explanation for the variation in NPL ratio.

TABLE 4.37: Impact of Macroeconomic Indicators and NPL (lag 1) on NPL Ratio (India).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0100	0.0020	4.9625	0.0000
Non-performing loans to gross advances(-1)	0.6749	0.0449	15.0054	0.0000
R-squared	0.4556	F-statistic		225.1644
Adjusted R-squared	0.4536	Prob(F-statistic)		0
Sum squared residuals	0.1572	Durbin-Watson stat		1.75779

4.3.2.6 Impact of Bank Specific, Industry Specific and Macroeconomic Indicators on NPL/Advance

Table 4.38 reports the combined effect of all types of significant variables on NPL ratio of Indian scheduled commercial banks.

TABLE 4.38: Impact of Bank & Industry Specific and Macroeconomic Indicators on NPL (India).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.0211	0.0202	-1.0477	0.2957
NPL to gross advances(-1)	0.6226	0.0396	15.7207	0.0000
Capital adequacy ratio	-0.1966	0.0361	-5.4392	0.0000
Capital adequacy ratio(-1)	0.1519	0.0378	4.0191	0.0001
Investment in unapproved securities	0.0327	0.0059	5.4746	0.0000
Investment in unapproved securities(-1)	-0.0255	0.0066	-3.8341	0.0002
Investment in unapproved securities(-2)	-0.0238	0.0054	-4.3780	0.0000
Return on equity	-0.1324	0.0148	-8.8954	0.0000
Return on equity(-1)	0.0656	0.0164	3.9967	0.0001
Interest rate(-2)	0.3493	0.0998	3.4978	0.0006
Consumer price index(-2)	0.1334	0.0388	3.4372	0.0007
Unemployment rate	0.9635	0.4043	2.3831	0.0179
Foreign direct investment as %age of GDP	-1.4348	0.3042	-4.7161	0.0000
R-squared	0.8438	F-statistic		115.6967
Adjusted R-squared	0.8365	Prob(F-statistic)		0
Sum squared residuals	0.0450	Durbin-Watson stat		1.9635

The values of F-stat, probability (F-statistic) suggest a good model fit (Table 4.38). All independent variables are significant with $\alpha = 100\%$ except unemployment rate

for which $\alpha = 95\%$. As evident from its t-statistic values, lag effect of NPL/advance (bank specific factor) is the most significant factor, followed by return on equity and investment in unapproved securities.

4.3.3 Checking Robustness and Validity of the Model-Back Testing

NPL/advance values of the sample banks are estimated during 1999-2014. To ascertain stability of banks, the equity/advance values (yearly basis) are subtracted from respective banks' estimated NPL/advance values. Results of the back testing i.e. the values of equity/advance minus estimated NPL/advance are given in Table 4.39. The negative value means that NPL/advance of the bank has exceeded its' equity/advance in the year under review and thus the bank is considered as unstable. In a press release on 25 Jun 2015, Reserve Bank of India had expressed concern over 'the continued weakness in asset quality of scheduled commercial banks, especially of public sector banks'. In this study, out of 17 sample banks, 13 are public sector banks (PSBs). The model correctly identified the public sector banks experiencing financial difficulty during 2012, 2013 and 2014. Except Allahabad and Syndicate banks which were estimated as stable during 2012 and 2013 respectively, all public sector banks were correctly estimated unstable during the period 2012-2014.

Another evidence of the validity and robustness of the model is that the signs of the regression coefficients are in unison with that of the past studies on the subject. Positive influence of capital adequacy ratio of the preceding year means that after bolstering the capital adequacy ratio, the banks feel secure and assume more risk by investing funds in riskier projects and/or issue advances by obtaining fewer guarantees. Unapproved securities are those which have not been issued, assumed or guaranteed by state. Negative effect of investment in unapproved securities in the preceding one and two years however, denotes that Indian banks have evolved better risk management techniques for investment in securities not issued or guaranteed by government. Positive effect of return on equity at the time

lag of one year indicates that to appease the shareholders the banks' management assume comparatively more risk.

TABLE 4.39: Results of Test for the Robustness of the Model (India).

Name of Bank	Category of Bank	2012	2013	2014
Allahabad Bank	Public sector bank		-0.0206	-0.0266
Andhra Bank	“	-0.0095	-0.0085	-0.0323
Bank of India	“	-0.0151	-0.0130	-0.0207
Canara Bank	“	-0.0115	-0.0162	-0.0259
Central Bank of India	“	-0.0192	-0.0146	-0.0387
IDBI Bank Limited	“	-0.0082	-0.0210	-0.0189
Indian Bank	“	-0.0046	-0.0097	-0.0191
Indian Overseas Bank	“	-0.0189	-0.0034	-0.0187
Oriental Bank of Commerce	“	-0.0267	-0.0120	-0.0216
Punjab National Bank	“	-0.0069	-0.0114	-0.0515
Syndicate Bank	“	-0.0104		-0.0095
Union Bank of India	“	-0.0148	-0.0148	-0.0178
State Bank of India	“	-0.0093	-0.0141	-0.0233

4.3.4 Stability Assessment of Banks 1999-2014

The empirical model developed on the basis of regression analysis is used to assess the stability of sample banks during the period 1999-2014. Past studies do not provide any guidance for terming a bank stable or unstable on the basis of comparing the values of a bank's estimated NPL (or NPL/advance) with its equity (or equity/advance). Therefore a new operational definition is introduced in this study. A bank is considered unstable during a year if its estimated NPL/advance exceeds its equity/advance during that year. Banks estimated unstable are further divided into two types on the basis of the significance of the (negative) value of estimated NPL/advance minus its equity/advance during a year. The value of estimated NPL/advance minus its equity/advance is significant if it is less than the average (average of values of all banks during a year) by more than one standard deviation. In this study the values of NPL/advance and equity/advance are taken in ratio form and therefore 0.01 has been taken equal to one standard deviation.

Results of the analysis in terms of estimated NPL/advance minus its equity/advance during a year are reported in Table 4.40. Results indicate that Citibank (foreign bank) assessed unstable during 2001-2 and 2005 only, is appraised the most stable bank during 1999-2014. Axis Bank (private sector bank) is adjudged the second most stable bank during the period under review. The bank is assessed stable during 12 year and unstable for 4 years only. HDFC Bank, another private sector bank is evaluated as third most stable bank during the sample period. HDFC Bank is evaluated unstable only for two years during the period under review i.e. 2012 and 2014, is considered less stable than Citibank and Axis Bank due to the reason that it has stumbled from state of stability to instability. ICICI Bank, again another private sector bank is appraised the fourth most stable bank. It remained unstable for 12 continuous years since 2001, but has achieved stability during the years 2013 and 2014. Remaining 13 banks are all public sector banks which are assessed considerably unstable during 1999-2005, showed some signs of recovery during 2006-2011 but slipped back and were evaluated markedly unstable during 2012-14. State Bank of India which is the biggest bank (in terms of assets), is the only bank that remained unstable throughout the period under review. It is very interesting to note that the four banks assessed comparatively stable include one foreign bank (Citibank) and three private sector banks (Axis, HDFC and ICICI). Remaining 13 banks assessed relatively unstable during the period under review especially during the last three years i.e. 2012-14, are all public sector banks.

TABLE 4.40: Results of Stability Assessment of Banks 1999-2014 (India).

Bank	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Citibank N.A	0.01	0.01	-0.00	-0.00	0.00	0.00	-0.00	0.01	0.04	0.07	0.06	0.07	0.08	0.07	0.07	0.05
Allahabad Bank	-0.02	-0.08	-0.08	-0.07	-0.10	-0.08	0.00	0.02	0.00	0.01	-0.00	0.01	0.01	0.00	-0.02	-0.03
Andhra Bank	0.02	0.05	0.03	0.03	-0.05	-0.05	0.04	0.03	0.01	0.02	0.02	0.02	0.02	-0.01	-0.01	-0.03
Bank of India	-0.03	-0.05	-0.05	-0.05	-0.08	-0.07	-0.03	0.00	0.01	0.00	0.01	0.00	0.00	-0.02	-0.01	-0.02
Canara Bank	-0.03	-0.05	-0.02	-0.02	-0.09	-0.10	-0.02	0.01	0.00	-0.00	0.00	0.00	0.01	-0.01	-0.02	-0.03
Central Bank of India	0.08	0.01	0.02	0.03	-0.04	-0.05	0.00	0.01	0.01	-0.00	0.00	0.00	0.02	-0.02	-0.01	-0.04
IDBI Bank Ltd	-0.04	0.07	0.04	0.01	0.03	0.03	-0.01	-0.01	0.00	-0.00	0.02	-0.01	0.01	-0.01	-0.02	-0.02
Indian Bank	0.24	0.23	0.21	0.27	0.28	0.25	0.24	0.03	0.04	0.02	0.02	0.00	0.01	-0.00	-0.01	-0.02
Indian Overseas Bank	-0.02	-0.04	-0.03	-0.02	-0.08	-0.07	0.01	0.03	0.02	0.01	0.01	-0.02	-0.01	-0.02	-0.00	-0.02
Oriental Bank of Commerce	-0.01	-0.03	-0.02	-0.01	-0.06	-0.07	0.00	0.00	-0.00	-0.01	-0.00	-0.00	0.00	-0.03	-0.01	-0.02
Punjab National Bank	-0.03	-0.06	-0.05	-0.03	-0.09	-0.07	0.01	0.01	0.00	0.00	0.01	0.01	0.01	-0.01	-0.01	-0.05
Syndicate Bank	-0.00	-0.00	-0.03	-0.02	-0.05	-0.08	-0.01	0.02	0.01	0.01	0.00	-0.01	0.01	-0.01	0.00	-0.01
Union Bank of India	-0.03	-0.07	-0.04	-0.04	-0.02	-0.03	-0.02	-0.01	0.01	0.01	0.01	0.00	0.01	-0.01	-0.01	-0.02
State Bank of India	-0.04	-0.05	-0.05	-0.04	-0.12	-0.10	-0.02	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	-0.02
Axis Bank	0.02	-0.01	-0.00	0.02	0.01	0.02	0.00	0.00	0.02	-0.02	-0.05	-0.03	0.00	0.00	0.02	0.00
HDFC Bank	0.11	0.10	0.04	0.04	0.01	0.02	0.01	0.01	0.02	0.00	0.01	0.01	0.00	-0.00	0.01	-0.03
ICICI Bank	0.06	0.03	-0.01	-0.01	-0.01	-0.02	-0.00	-0.01	-0.00	-0.00	-0.02	-0.01	-0.00	-0.01	0.00	0.00
Standard Deviation	0.07	0.08	0.07	0.07	0.09	0.08	0.06	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Number of unstable Banks	10	10	11	11	12	12	8	4	3	7	5	7	3	14	12	14

TABLE 4.41: Results of Stability Assessment of Banks 1999-2014 (India).

Bank	Category	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Citibank N.A	Foreign			x	x			x									
Allahabad Bank	Public	x	x	s	x	s	x					x				x	S
Andhra Bank	“					x	x								x	x	S
Bank of India	“	x	x	x	x	x	x	x							x	x	X
Canara Bank	“	x	x	x	x	x	s	x			x				x	x	S
Central Bank of India	“					x	x				x				x	x	S
IDBI Bank Ltd	“	x						x	x		x		X		x	x	X
Indian Bank	“														x	x	X
Indian Overseas	“	x	x	x	x	x	x						X	X	x	x	X
Oriental Bank of Commerce	“	x	x	x	x	x	x			x	x	x	X		x	s	X
Punjab National Bank	“	x	x	x	x	x	x								x	x	S
Syndicate Bank	“	x	x	x	x	x	x	x					X		x		X
Union Bank of India	“	x	x	x	x	x	x	x	x						x	x	X
State Bank of India	“	x	x	x	x	s	s	x	x	x	x	x	X	X	x	x	X
Axis Bank	Private		x								x	s	S				
HDFC Bank	“														x		S
ICICI Bank	“			x	x	x	x	x	x	x	x	x	X	X	x		
Number of banks unstable by significant margin		0	0	2	0	2	2	0	0	0	0	1	1	0	0	1	6
%age assets of significantly unstable banks		0	0	5.3	0	34	39	0	0	0	0	4	4	0	0	3	30
No of unstable banks		10	10	11	11	12	12	8	4	3	7	5	7	3	14	12	14

In Table 4.41, the blank space means that the bank has been estimated as stable during the year under consideration, which means that NPL/advance estimated for a bank has been less than its equity advance during the year being reviewed. A bank assessed as unstable during a year has either been marked 'x' or 's' on the basis of significance of the value of a bank's estimated NPL/advance minus its equity/advance during that year. The value of NPL/advance minus its equity/advance is significant if it is less than the average (average of values of all banks during a year) by more than one standard deviation and marked as 's'. Mark 'x' means that although the estimated NPL/advance of a bank has exceeded its equity/advance during that year but not by a significant margin i.e. by less than one standard deviation. In this study the values of NPL/advance and equity/advance are taken in ratio form and therefore here 0.01 has been taken equal to one standard deviation.

Analysis results based on the significance of the (negative) NPL/advance minus its equity/advance values during a year are reported in Table 4.41. No bank is significantly unstable during the years 1999, 2000, 2002, 2005-2008, 2011 and 2012. One bank i.e. Allahabad bank is significantly unstable during 2001. Two banks each (both public sector), are significantly unstable during 2003 and 2004. Axis bank which is a private sector bank is significantly unstable during 2009 and 2010 but stable afterward. Six banks are significantly unstable during 2014. During the last three years 2012-2014, the total number of unstable banks has increased and during 2014 the number of significantly unstable banks has markedly increased. It can be concluded that Indian banking system is exhibiting a gradual negative trend.

4.3.5 Stability Assessment of Overall Banking System 1999-2014

The empirical model developed is used to assess the stability of whole banking system during the period 1999-2014. Literature review does not provide any insight to term a banking system stable or unstable on the basis of assets controlled

by unstable banks. Therefore for this purpose, a new operational definition is developed in this study. Banking sector is termed unstable, less stable or stable during a year if total assets of all banks assessed as unstable were respectively more than 20%, 10-20% or less than 10% of total assets of all the sample banks. The results (Table 4.42) suggest that Indian banking system remained unstable during the whole sample period of 1999-2014. It has shown some signs of recovery during 2005-11, but has slipped back and remained unstable during 2012-14. However, when we analyze the stability of banking system on the basis of 'significance' of the estimated NPL/advance minus equity/advance value, overall banking system is assessed financially stable during 1999-2002 and 2005-2013. The system is, adjudged unstable during 2003-2004 and 2014 only. The instability of the Indian banking system in 2014 is more noteworthy when six banks possessing 30% assets of the banking system are appraised unstable by significant margin. The number of banks adjudged significantly unstable is (maximum) two during 1999-2013 but abruptly increases to six in 2014.

TABLE 4.42: Results of Stability Assessment of Banking System 1999-2014 (India).

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of stable banks	7	7	6	6	5	5	9	13	14	10	12	10	14	3	5	3
Number of unstable banks	10	10	11	11	12	12	8	4	3	7	5	7	3	14	12	14
Number of unstable banks as %age of all banks	59	59	65	65	71	71	47	24	18	41	29	41	18	82	71	82
%age assets of unstable banks	85	81	84	85	89	88	69	54	42	60	46	53	34	88	74	84
Status of stability of banking system	Unstable															

TABLE 4.43: Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance (1999-2014)-India.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of banks unstable by significant margin	0	0	1	0	2	2	0	0	0	0	1	1	0	0	1	6
%age assets of significantly unstable banks	0	0	5.3	0	34	39	0	0	0	0	4	4	0	0	3	30
Status of stability of banking system	Stable			Unstable			Stable									Unstable

4.3.6 Stress Testing of Stability of Banks

Using the results related to the stability of commercial banks reported in Table 4.40-4.43, stability of whole banking sector is estimated in all the sample years under various scenarios. Literature review does not provide any insight to term a banking system stable or unstable on the basis of assets controlled by unstable banks. Therefore for this purpose, a new operational definition is developed in this study. Banking sector is termed unstable, less stable or stable during a year if total assets of all banks assessed unstable are respectively more than 20%, 10-20% or less than 10% of total assets of all the sample banks.

Average (mean values during sample period), mean (mean of average and worst values during sample period) and worst values of macroeconomic indicators (MEI) during sample period are used for normal (scenario 1), bad (scenario 2) and worst (scenario 3) economic conditions respectively.

4.3.6.1 Stress Testing of Stability of Banking System in Normal Economic Conditions-Scenario 1

Average values of macroeconomic indicators (MEI) during sample period are used to represent normal economic conditions (scenario 1). Results for stress testing for normal economic conditions (scenario-1) are appended in Table 4.44. Negative sign of a value means that the estimated value of NPL/advance of the bank has surpassed the value of its equity/advance during the year under review.

The results suggest that in normal economic conditions, the three private sector banks i.e. Axis, HDFC and ICICI banks, are estimated to have only borderline stability. Although Axis Bank and HDFC Bank are estimated to have been stable during 2012-13 and 2013 respectively, both these banks are evaluated unstable during 2014. Citibank (foreign bank) is the only bank appraised capable to retain its stability. The remaining 13 banks (all public sector banks) are assessed unstable especially during the last 3 years of sample period. Number of unstable banks has exhibited an upward trend during the period being reviewed.

Table 4.45 reports the result of banks in terms of the significance of the estimated NPL/advance minus equity/advance value. Results (Table 4.45) suggest that during 1999-2002, a minimum number of six (and maximum 10 banks are estimated unstable, but no bank is evaluated unstable significantly. The number of banks estimated unstable shows an upward trend throughout the period under review. The number of banks assessed significantly unstable also show an upward trend throughout this period. No bank is estimated significantly unstable during 1999-2002, 2005, 2007, and 2011. One bank each is evaluated significantly unstable during 2003, 2004, 2006, 2008 and 2009. During 2010 and 2013, two banks each are considered significantly unstable. During 2014, there is a marked increment in the number of unstable banks. Nine banks are evaluated significantly unstable during normal economic conditions. Out of these nine banks, eight are public sector banks while one is private sector bank. Citibank (foreign bank), Indian Bank and Syndicate Bank (public sector banks), ICICI Bank (private sector bank) are the only four banks adjudged stable during the period under review.

TABLE 4.44: Results of Stress Testing of Stability of Banks-Scenario 1 (India).

Bank	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Citibank N.A	-0.01	0.01	0.00	0.00	0.00	0.00	-0.00	0.01	0.04	0.07	0.06	0.07	0.08	0.07	0.07	0.05
Allahabad Bank	0.01	-0.07	-0.07	-0.06	-0.09	-0.08	0.00	0.02	-0.00	-0.00	-0.01	0.01	-0.00	-0.00	-0.03	-0.03
Andhra Bank	0.05	0.07	0.03	0.03	-0.05	-0.05	0.04	0.03	0.00	0.01	0.01	0.02	0.01	-0.01	-0.02	-0.04
Bank of India	-0.01	-0.04	-0.03	-0.03	-0.08	-0.07	-0.03	-0.00	0.00	0.01	0.01	-0.02	-0.01	-0.01	-0.02	-0.03
Canara Bank	-0.00	-0.04	-0.02	-0.02	-0.09	-0.10	-0.03	0.01	-0.01	-0.01	-0.00	-0.00	0.00	-0.02	-0.02	-0.03
Central Bank of India	0.11	0.03	0.02	0.04	-0.04	-0.05	0.00	0.01	-0.00	-0.01	-0.00	-0.00	-0.00	-0.02	-0.02	-0.04
IDBI Bank Ltd	-0.02	0.09	0.05	0.02	0.03	0.03	-0.01	-0.01	-0.01	-0.01	0.01	-0.02	-0.00	-0.01	-0.03	-0.02
Indian Bank	0.26	0.24	0.22	0.27	0.29	0.25	0.24	0.03	0.03	0.01	0.01	-0.00	-0.00	-0.00	-0.02	-0.02
Indian Overseas Bank	0.00	-0.02	-0.02	-0.01	-0.08	-0.07	0.01	0.03	0.01	0.01	-0.00	-0.03	-0.02	-0.02	-0.01	-0.02
Oriental Bank of Commerce	0.01	-0.01	-0.02	-0.01	-0.06	-0.06	0.00	0.00	-0.01	-0.02	-0.01	-0.01	-0.01	-0.03	-0.02	-0.03
Punjab National Bank	0.00	-0.05	-0.05	-0.02	-0.08	-0.07	0.01	0.01	-0.01	-0.00	0.00	0.01	-0.01	-0.01	-0.02	-0.06
Syndicate Bank	0.02	0.01	-0.02	-0.01	-0.05	-0.07	-0.01	0.02	0.00	-0.00	-0.00	-0.02	-0.01	-0.01	0.00	-0.02
Union Bank of India	-0.00	-0.06	-0.03	-0.03	-0.01	-0.03	-0.02	-0.02	-0.00	0.00	0.00	-0.00	-0.01	-0.01	-0.02	-0.02
State Bank of India	-0.01	-0.03	-0.05	-0.03	-0.12	-0.10	-0.02	-0.01	-0.02	-0.01	-0.01	-0.02	-0.02	-0.01	-0.02	-0.03
Axis Bank	0.04	0.00	0.01	0.02	0.02	0.02	0.00	-0.00	0.01	-0.03	-0.06	-0.03	-0.01	0.00	-0.01	-0.00
HDFC Bank	0.14	0.11	0.05	0.04	0.02	0.02	0.01	0.01	0.01	-0.00	0.01	0.00	-0.01	-0.00	0.00	-0.03
ICICI Bank	0.09	0.04	-0.00	-0.01	-0.01	-0.02	-0.00	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02	-0.01	0.00	-0.00
Standard Deviation	0.07	0.08	0.07	0.07	0.09	0.08	0.06	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Number of unstable Banks	6	9	10	10	12	12	8	6	9	11	9	12	14	15	14	16

TABLE 4.45: Unstable Banks during Normal Economic Conditions (Scenario 1)-India.

Bank	Category	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Citibank N.A	Foreign	x	x					x									
Allahabad Bank	Public		x	x	x	x	x			x	x	x		X	x	s	s
Andhra Bank	“					x	x								x	x	s
Bank of India	“	x	x	x	x	x	x	x	x				x	X	x	x	s
Canara Bank	“	x	x	x	x	x	x	x		x	x	x	x	X	x	x	s
Central Bank of India	“					x	x			x	x	x	x		x	x	s
IDBI Bank Ltd	“	x						x	x	x	x		x	X	x	s	x
Indian Bank	“												x	X	x	x	x
Indian Overseas	“		x	x	x	x	x					x	s	X	x	x	x
Oriental Bank of Commerce	“		x	x	x	x	x			x	x	x	x	X	s	x	s
Punjab National Bank	“		x	x	x	x	x			x	x			X	x	x	s
Syndicate Bank	“			x	x	x	x	x			x	x	x	X	x	x	x
Union Bank of India	“	x	x	x	x	x	x	x	s	x			x	X	x	x	x
State Bank of India	“	x	x	x	x	s	s	x	x	x	x	x	x	X	x	x	s
Axis Bank	Private								x		s	s	s	X			x
HDFC Bank	“										x			X	x		s
ICICI Bank	“			x	x	x	x	x	x	x	x	x	x	X	x	x	x
Number of banks unstable by significant margin		0	0	0	0	1	1	0	1	0	1	1	2	0	1	2	9
%age assets of significantly unstable banks		0	0	0	0	4	32	0	4	0	4	4	8	0	9	30	66
No of unstable banks		6	9	10	10	12	12	8	6	9	11	9	12	14	15	14	16

4.3.6.2 Stress Testing of Banks-Bad Economic Conditions (Scenario 2)

Table 4.46 reports the results of stress testing in bad economic conditions. In scenario 2 conditions (Table 4.46), Citibank is again the only bank estimated to retain its stable position. Indian Bank (a public sector bank) has shown muscles till 2008. Andhra Bank (another public sector bank) is also evaluated to offer some resistance till 2006. All Indian banks, both public and private sector, are assessed to lose its stability in 2009 and onward in bad economic conditions.

Results of unstable banks in terms of 'significance' of instability in bad economic conditions are given in table 4.47. In terms of significance of NPL/advance minus its equity/advance values, Indian banking system is assessed to gradually lose its stability. No bank is estimated significantly unstable during 1999 and 2000. One bank each is evaluated significantly unstable during 2001 and 2002. The number of such banks is estimated to swell up to four and eight during 2003 and 2004 respectively. There is a marked improvement in the stability of banks after 2004 till 2011. The number of significantly unstable banks is estimated to swell up to six and five during 2012 and 2013 respectively and then suddenly rise to thirteen during 2014. Citibank (foreign bank) is the only bank estimated to avoid significant instability during bad economic conditions. Although HDFC bank is estimated significantly unstable during 2014, the three private sector banks i.e. Axis, HDFC and ICICI are estimated to perform satisfactorily specially during the last four years of the period under review. Public sector banks are evaluated to lose stability during bad economic conditions. During 2014, twelve (out of total thirteen) public sector banks are evaluated significantly unstable.

TABLE 4.46: Results of Stress Testing of Stability of Banks-Scenario 2 (India).

Bank	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Citibank N.A	-0.01	-0.01	-0.00	-0.00	-0.00	-0.00	-0.00	-0.01	0.04	0.07	0.06	0.07	0.08	0.07	0.07	0.05
Allahabad Bank	-0.01	-0.08	-0.09	-0.08	-0.11	-0.09	-0.01	0.01	-0.02	-0.02	-0.02	-0.01	-0.02	-0.02	-0.04	-0.05
Andhra Bank	0.03	0.05	0.02	0.02	-0.06	-0.07	0.03	0.02	-0.01	-0.00	-0.00	0.00	-0.01	-0.02	-0.03	-0.05
Bank of India	-0.03	-0.05	-0.05	-0.05	-0.09	-0.09	-0.04	-0.01	-0.01	-0.01	-0.01	-0.03	-0.03	-0.03	-0.03	-0.04
Canara Bank	-0.02	-0.05	-0.03	-0.03	-0.10	-0.11	-0.04	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.04	-0.04	-0.05
Central Bank of India	0.09	0.01	0.01	0.02	-0.05	-0.06	-0.01	-0.00	-0.02	-0.02	-0.02	-0.02	-0.01	-0.03	-0.04	-0.06
IDBI Bank Ltd	-0.03	0.07	0.03	0.01	0.01	0.02	-0.03	-0.02	-0.02	-0.02	-0.00	-0.03	-0.02	-0.02	-0.04	-0.04
Indian Bank	0.25	0.22	0.21	0.26	0.27	0.24	0.22	0.02	0.02	0.00	-0.00	-0.02	-0.02	-0.02	-0.03	-0.04
Indian Overseas Bank	-0.01	-0.04	-0.04	-0.02	-0.09	-0.09	0.00	-0.01	0.00	-0.01	-0.01	-0.04	-0.04	-0.03	-0.02	-0.04
Oriental Bank of Commerce	-0.00	-0.03	-0.03	-0.02	-0.07	-0.08	-0.01	-0.01	-0.02	-0.03	-0.02	-0.03	-0.03	-0.04	-0.03	-0.04
Punjab National Bank	-0.01	-0.06	-0.06	-0.04	-0.10	-0.09	-0.00	0.01	-0.02	-0.02	-0.01	-0.01	-0.02	-0.02	-0.03	-0.07
Syndicate Bank	0.01	-0.00	-0.04	-0.03	-0.06	-0.09	-0.03	0.00	-0.01	-0.01	-0.02	-0.03	-0.02	-0.02	-0.02	-0.03
Union Bank of India	-0.02	-0.07	-0.05	-0.05	-0.03	-0.04	-0.04	-0.03	-0.02	-0.01	-0.01	-0.02	-0.02	-0.03	-0.03	-0.04
State Bank of India	-0.03	-0.05	-0.06	-0.05	-0.13	-0.11	-0.03	-0.02	-0.04	-0.03	-0.03	-0.04	-0.04	-0.02	-0.04	-0.04
Axis Bank	-0.03	-0.01	-0.01	0.01	0.00	0.01	-0.01	-0.02	-0.01	-0.04	-0.07	-0.05	-0.03	-0.01	0.00	-0.02
HDFC Bank	0.12	0.10	0.04	0.03	0.00	0.01	-0.00	-0.01	-0.00	-0.02	-0.01	-0.01	-0.03	-0.01	-0.01	-0.05
ICICI Bank	0.07	0.03	-0.01	-0.02	-0.02	-0.03	-0.02	-0.02	-0.02	-0.02	-0.04	-0.03	-0.03	-0.02	-0.02	-0.02
Standard Deviation	0.07	0.08	0.07	0.07	0.09	0.08	0.06	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.03	0.03
Number of unstable Banks	11	11	12	11	13	13	15	12	14	15	16	15	16	16	16	16

TABLE 4.47: Unstable Banks during Bad Economic Conditions (Scenario 2)-India.

Bank	Category	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Citibank N.A	Foreign	x	x	x	x	x	x	x	x								
Allahabad Bank	Public	x	x	s	s	s	s	x		x	x	x	x	X	x	s	s
Andhra Bank	“					x	x			x	x	x		X	x	x	s
Bank of India	“	x	x	x	x	s	s	x	x	x	x	x	x	X	s	x	s
Canara Bank	“	x	x	x	x	s	s	x	x	x	x	x	x	X	s	s	s
Central Bank of India	“					x	x	x	x	x	x	x	x	X	s	s	s
IDBI Bank Ltd	“	x						x	x	x	x	x	x	X	x	s	s
Indian Bank	“											x	x	X	x	x	s
Indian Overseas	“	x	x	x	x	x	s	x			x	x	s	S	s	x	s
Oriental Bank of Commerce	“	x	x	x	x	x	s	x	x	x	s	x	x	X	s	x	s
Punjab National Bank	“	x	x	x	x	x	s	x	x	x	x	x	x	X	x	x	s
Syndicate Bank	“		x	x	x	x	s	x		x	x	x	x	X	x	x	x
Union Bank of India	“	x	x	x	x	x	x	x	s	x	x	x	x	X	s	x	s
State Bank of India	“	x	x	x	x	s	s	x	x	s	s	x	s	S	x	s	s
Axis Bank	Private	x	x	x				x	x	x	s	s	s	X	x	x	X
HDFC Bank	“							x	x	x	x	x	x	X	x	x	S
ICICI Bank	“			x	x	x	X	x	x	x	x	s	x	X	x	x	X
Number of banks unstable by significant margin		0	0	1	1	4	8	0	1	1	3	2	3	2	6	5	13
%age assets of significantly unstable banks		0	0	3	3	50	67	0	4	24	32	11	32	27	50	43	84
No of unstable banks		11	11	12	11	13	13	15	12	14	15	16	15	16	16	16	16

4.3.6.3 Stress Testing of Banks-Worst Economic Conditions (Scenario 3)

To assess robustness of the bank, stress testing is carried out for its performance in worst economic conditions. As discussed above, worst economic conditions mean the worst values of macroeconomic indicators during the sample period in our model (with mean values of bank specific and industry specific indicators).

Results of stress testing of banks in worst economic conditions (scenario 3) are reported in Table 4.48 and 4.49. Citibank (foreign bank) is the only bank assessed to withstand worst economic conditions. Indian bank (a public sector bank) is evaluated to exhibit resilience till 2007. Andhra Bank (another public sector bank) is also evaluated to offer some resistance till 2006. All Indian banks, both public and private sector, are assessed to lose its stability in 2008 and onward in worst economic conditions.

Results of unstable banks in terms of ‘significance’ of instability in worst economic conditions are given in Table 4.49. Citibank (foreign bank) is the only bank assessed to avoid significant instability during worst economic conditions. Although HDFC Bank is estimated significantly unstable during 2014, the three private sector banks i.e. Axis, HDFC and ICICI are estimated to perform satisfactorily specially during the last three years of the period under review. Public sector banks are evaluated to lose stability during worst economic conditions. During 2013, twelve (out of total thirteen) public sector banks are evaluated significantly unstable while during 2014, all the thirteen public sector banks are appraised significantly unstable.

TABLE 4.48: Results of Stress Testing of Stability of Banks-Scenario 3 (India).

Bank	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Citibank N.A	-0.01	-0.01	-0.00	-0.00	-0.00	-0.00	-0.00	-0.01	0.04	0.07	0.06	0.07	0.08	0.07	0.07	0.05
Allahabad Bank	-0.02	-0.10	-0.10	-0.09	-0.12	-0.10	-0.03	-0.01	-0.03	-0.03	-0.04	-0.02	-0.03	-0.03	-0.06	-0.06
Andhra Bank	0.02	0.04	0.00	0.01	-0.08	-0.08	0.01	0.00	-0.03	-0.02	-0.02	-0.01	-0.02	-0.04	-0.04	-0.07
Bank of India	-0.04	-0.07	-0.06	-0.06	-0.11	-0.10	-0.06	-0.03	-0.03	-0.02	-0.02	-0.05	-0.04	-0.04	-0.05	-0.06
Canara Bank	-0.03	-0.07	-0.05	-0.04	-0.12	-0.13	-0.05	-0.02	-0.04	-0.04	-0.03	-0.03	-0.03	-0.05	-0.05	-0.06
Central Bank of India	0.08	0.00	-0.01	0.01	-0.06	-0.08	-0.03	-0.02	-0.03	-0.04	-0.03	-0.03	-0.03	-0.05	-0.05	-0.07
IDBI Bank Ltd	-0.05	0.06	0.02	-0.01	0.00	0.01	-0.04	-0.04	-0.04	-0.04	-0.02	-0.05	-0.03	-0.04	-0.06	-0.05
Indian Bank	0.23	0.21	0.19	0.25	0.26	0.22	0.21	0.00	0.00	-0.01	-0.01	-0.03	-0.03	-0.03	-0.05	-0.05
Indian Overseas Bank	-0.03	-0.05	-0.05	-0.04	-0.11	-0.10	-0.02	-0.00	-0.01	-0.02	-0.03	-0.05	-0.05	-0.05	-0.04	-0.05
Oriental Bank of Commerce	-0.02	-0.04	-0.05	-0.03	-0.08	-0.09	-0.03	-0.03	-0.04	-0.05	-0.03	-0.04	-0.04	-0.06	-0.05	-0.06
Punjab National Bank	-0.03	-0.07	-0.07	-0.05	-0.11	-0.10	-0.02	-0.02	-0.04	-0.03	-0.02	-0.02	-0.03	-0.04	-0.05	-0.09
Syndicate Bank	-0.00	-0.02	-0.05	-0.04	-0.08	-0.10	-0.04	-0.01	-0.03	-0.03	-0.03	-0.04	-0.04	-0.04	-0.03	-0.04
Union Bank of India	-0.03	-0.09	-0.06	-0.06	-0.04	-0.06	-0.05	-0.04	-0.03	-0.02	-0.03	-0.03	-0.04	-0.04	-0.05	-0.05
State Bank of India	-0.04	-0.06	-0.08	-0.06	-0.15	-0.13	-0.05	-0.04	-0.05	-0.04	-0.04	-0.05	-0.05	-0.04	-0.05	-0.06
Axis Bank	-0.02	-0.03	-0.02	-0.01	-0.01	-0.01	-0.03	-0.03	-0.02	-0.05	-0.09	-0.06	-0.04	-0.02	-0.02	-0.03
HDFC Bank	0.11	0.08	0.02	0.01	-0.01	-0.00	-0.02	-0.02	-0.02	-0.03	-0.02	-0.03	-0.04	-0.03	-0.03	-0.06
ICICI Bank	0.06	0.01	-0.03	-0.04	-0.04	-0.04	-0.03	-0.04	-0.04	-0.04	-0.05	-0.04	-0.05	-0.03	-0.03	-0.03
Standard Deviation	0.07	0.08	0.07	0.07	0.09	0.08	0.06	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Number of unstable Banks	12	12	13	13	15	15	15	15	15	16	16	16	16	16	16	16

TABLE 4.49: Unstable Banks during Bad Economic Conditions (Scenario 3)-India.

Bank	Category	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Citibank N.A	Foreign	x	x	x	x	x	X	x	x								
Allahabad Bank	Public	x	s	s	s	s	S	x	x	s	X	s	x	X	x	s	s
Andhra Bank						x	X			s	X	x	x	X	s	s	s
Bank of India		x	x	x	x	s	S	x	s	s	X	x	s	S	s	s	s
Canara Bank		x	x	x	x	s	S	x	x	s	S	x	x	X	s	s	s
Central Bank of India			x	x		x	X	x	x	s	S	x	x	X	s	s	s
IDBI Bank Ltd		x			x			x	s	s	S	x	s	X	s	s	s
Indian Bank											X	x	x	X	x	s	s
Indian Overseas		x	x	x	x	s	S	x	x	x	X	x	s	S	s	s	s
Oriental Bank of Commerce		x	x	x	x	x	S	x	s	s	S	x	s	S	s	s	s
Punjab National Bank		x	x	x	x	s	S	x	x	s	X	x	x	X	s	s	s
Syndicate Bank		x	x	x	x	x	S	x	x	s	X	x	s	S	s	x	s
Union Bank of India		x	s	x	x	x	X	x	s	s	X	x	x	S	s	s	s
State Bank of India		x	x	s	x	s	S	x	s	s	S	s	s	S	s	s	s
Axis Bank	Private	x	x	x	x	x	X	x	s	x	S	s	s	S	x	x	x
HDFC Bank						x	X	x	x	x	X	x	x	S	x	x	s
ICICI Bank				x	x	x	X	x	s	s	S	s	s	S	x	x	x
Number of banks unstable by significant margin		0	2	2	1	6	8	0	7	12	7	4	8	9	11	12	14
%age assets of significantly unstable banks		0	5	41	2	62	67	0	65	87	61	50	60	67	70	71	87
No of unstable banks		12	12	13	13	15	15	15	15	15	16	16	16	16	16	16	16

4.3.7 Stress Testing of Stability of Overall Banking System

Using the results related to the stability of commercial banks reported in Table 4.43-4.49, stability of whole banking sector is determined in all the sample years under various scenarios. Literature review does not provide any insight to term a banking system stable, less stable or unstable on the basis of assets controlled by unstable banks. Therefore for this purpose, a new operational definition is developed in this study. Banking sector is termed unstable, less stable or stable during a year if total assets of all banks assessed as unstable are respectively more than 20%, 10-20% or less than 10% of total assets of all the sample banks. Results for all the three scenarios are given in Table 4.50-4.55.

4.3.7.1 Stress Testing of Stability of Banking System in Normal, Bad and Worst Economic Conditions

Three scenarios are developed for stress testing. Scenario 1 represent normal economic condition using average values of macroeconomic indicators during sample period. Scenario 3 represents worst economic condition and is represented by the worst values of macroeconomic indicators (MEI) during sample period. Scenario 2 is developed for bad economic condition and represents conditions between normal and worst economic conditions. Mean of the average and worst values of macroeconomic indicators during sample period are used to surrogate bad economic conditions.

When we analyze Indian banks (and banking system) on the basis of estimated NPL/advance surpassing equity advance, the banking system of India is assessed unstable throughout the sample period i.e. 1999-2014 in all the scenarios (see Table 4.50, 4.51 and 4.52). The results of stress testing denote that Indian banking system is not capable to withstand macroeconomic shock(s).

TABLE 4.50: Stress Testing of Stability of Banking System-Normal Economic Conditions (India).

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of unstable banks	6	9	10	10	12	12	8	6	9	11	9	12	14	15	14	16
Number of stable banks	11	8	7	7	5	5	9	11	8	6	8	4	3	2	3	1
Number of unstable banks as %age of all banks	35	53	59	59	71	71	47	35	53	65	53	76	82	88	82	94
%age assets of unstable banks	66	75	84	83	89	88	70	62	72	79	65	79	89	92	86	98
Status of stability of banking system	Unstable															

TABLE 4.51: Stress Testing of Stability of Banking System-Bad Economic Conditions (India).

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of unstable banks	11	11	12	11	13	13	15	12	14	15	16	15	16	16	16	16
Number of stable banks	6	6	5	6	4	4	2	4	3	2	1	2	1	1	1	1
Number of unstable banks as %age of all banks	65	65	71	65	76	76	88	76	82	88	94	88	94	94	94	94
%age assets of unstable banks	85	84	86	85	92	91	95	88	91	95	97	93	96	98	98	98
Status of stability of banking system	Unstable															

TABLE 4.52: Stress Testing of Stability of Banking System-Worst Economic Conditions (India).

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of unstable banks	12	12	13	13	15	15	15	15	15	16	16	16	16	16	16	16
Number of stable banks	5	5	4	3	2	2	2	2	2	1	1	1	1	1	1	1
Number of unstable banks as %age of all banks	70	70	76	82	88	88	88	88	88	94	94	94	94	94	94	94
%age assets of unstable banks	89	90	92	87	96	96	95	96	95	97	97	96	96	98	98	98
Status of stability of banking system	Unstable															

TABLE 4.53: Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-Scenario 1 (India).

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of banks unstable by significant margin	0	0	0	0	1	1	0	1	0	1	1	2	0	1	2	9
%age assets of significantly unstable banks	0	0	0	0	34	32	0	4	0	4	4	8	0	9	30	66
Status of stability of banking system	Stable				Unstable			Stable							Unstable	

However, when we scrutinize Indian commercial banks in terms of significance of the value of NPL/advance minus equity/advance, the results are somewhat different. In normal economic conditions (scenario-1), the overall banking system is assessed financially stable during 1999-2002 and 2005-2012 (Table 4.53). The system is however, adjudged unstable during 2003-2004 and 2013-2014. The instability of the Indian banking system in 2014 is more noteworthy when nine banks possessing 66% assets of the banking system are unstable by significant margin. In terms of number of banks, the number of banks assessed significantly unstable is maximum two during 1999-2013 but abruptly increases to nine in 2014.

In bad economic conditions, banking system of India is assessed as stable during 1999-2002, then during 2007-2008 and less stable during 2009 (Table 4.54). The system is assessed unstable during the remaining years of the period under review. The system is appraised markedly unstable during the period 2012-2014. During 2014 thirteen (out of total 17) banks are assessed unstable. These banks are in possession of 84% assets of the banking sector of India.

In worst economic conditions, banking system of India is assessed as stable during 1999 -2000, 2002 and then during 2005 only (Table 4.55). The system is assessed unstable during the remaining years of the period under review. The system is appraised markedly unstable during the period 2006-2014. During 2014 fourteen (out of total 17) banks are assessed unstable by significant margin. These banks are in possession of 87% assets of the banking sector of India.

TABLE 4.54: Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-Scenario 2 (India).

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of banks unstable by significant margin	0	0	1	1	4	8	0	1	1	3	2	3	2	6	5	13
%age assets of significantly unstable banks	0	0	3	3	50	67	0	4	24	32	11	32	27	50	43	84
Status of stability of banking system	Stable			Unstable			Stable		Unstable		Less Stable	Unstable				

TABLE 4.55: Analysis in Terms of Significance of the Value of NPL/advance minus Equity/Advance-Scenario 3 (India).

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of banks unstable by significant margin	0	2	2	1	6	8	0	7	12	7	4	8	9	11	12	14
%age assets of significantly unstable banks	0	5	41	2	62	67	0	65	87	61	50	60	67	70	71	87
Status of stability of banking system	Stable		Unstable	Stable	Unstable		Stable	Unstable								

Chapter 5

Conclusion and Recommendations

Analysts other than IMF and Central Banks' staff have not appraised financial sectors of Pakistan and India comprehensively. Studies made so far have restricted its scope to a specific group of banks. Stability of individual banks has not been evaluated. These studies have used macroeconomic and bank level factors for its clout on non-performing loan ratios of banks and then using estimated non-performing loan ratios only as a yard stick for evaluating the stability of banks. This study is the first of its kind by adding new dimensions to the analysis of the stability analysis of individual banks and overall banking system of Pakistan and India.

5.1 Methods and Procedures

5.1.1 Research Design

A new design of study has been developed for this study. It is a mix of the models used by independent analysts and regulators. Determinants of asset quality of commercial banks are identified and its influence on NPL ratio explored empirically. The model used by regulators and financial institutions for stress testing

and scenario analysis are employed but in simplified form. Pakistan and India have not passed through financial crisis due to some shock/contagion, therefore stress events and its impact on macroeconomic indicators is not included in the design. However, scenarios are developed for stress testing on the basis of extreme values of macroeconomic variables during sample period and its influence on the stability of individual financial institutions and whole banking systems explored. Our research design includes five steps.

5.1.2 Steps of Research

Each banking system is appraised separately in five steps. Step one is based on the methodology adopted by past studies made by independent analysts i.e. analysts other than IMF and Central Banks' staff. In this step, using data of the sample banks during the sample period, an empirical model is developed for estimation of NPL/Advance ratio, using various macroeconomic indicators (MEI), bank specific factors (BSF) and industry specific indicators (ISI) as regressors. Empirical models are developed separately for Pakistan and India.

$$\text{NPL/Advance} = \alpha_0 + \alpha_1(\text{BSF})_{i,t} + \alpha_2(\text{ISI})_{i,t} + \alpha_3(\text{MEI})_{i,t} + \xi_{i,t} \quad (\text{Model 1})$$

In second step, the robustness and validity of the model is checked by 'back testing'. In step three, the empirical model is employed to evaluate the stability of all the banks during sample period. This step adds a new dimension to the studies conducted in the past i.e. comparing estimated NPL ratio of a bank in a certain year to the equity ratio of concerned bank in the year under review. A bank is considered unstable during a year if its estimated NPL/advance exceeds its equity/advance. The results of stability of individual banks are also used to ascertain the stability of whole banking sector during sample period. Banking sector is termed unstable, less stable or stable during a year if total assets of all banks assessed as unstable were found more than 20%, 10-20% or less than 10% of total assets of all the sample banks, respectively.

Financial system regulators i.e. IMF and Central Banks staff use techniques of stress testing to adjudge the resilience of bank and overall banking sector against macroeconomic shocks. Taking lead from the studies made by regulators, stress testing of all the sample banks is carried out under various scenarios, developed on the basis of extreme (average and worst) values of significant macroeconomic and industry specific indicators during sample period.

In step five, using stability of banking sector is determined in all the sample years on the basis of stability status estimated in step three and the resilience of whole banking sectors to withstand macroeconomic shocks determined under various scenarios.

5.2 Major Findings

5.2.1 Banking System of Pakistan

The results of the study reveal that to take stock of the stability of Pakistani financial system, the period 1998-2014 can be divided into four phases.

- The first phase (1998-2001) encompassing the first four years of sample period can be described as the highly arduous period for financial sector of Pakistan. During this period, out of 18 banks being reviewed, 4-10 banks were assessed unstable in different years by finding its equity/advance ratios lagging behind its estimated NPL/advance ratios. As a whole the financial system was evaluated as grimly unstable because the banks assessed unstable were collectively in control of 40-50% of the total assets of whole financial sector, during different years of this phase. Analysis of the stability of banks on the basis of only significant values of NPL/advance minus equity/advance, also support this finding. A total of minimum 2 and maximum 4 banks were adjudged unstable in different years by finding its equity/advance ratios lagging behind its NPL/advance ratios by significant margin. These banks evaluated unstable (by significant margin) were in possession of

more than 18 percent (18-45%) assets of the financial sector. Stress testing results also endorse the conclusion. In normal economic conditions (scenario 1), minimum 4 and maximum 11 banks controlling more than 35% assets (35-70%) are assessed unstable during 1998-2001. Out of these bank assessed unstable in normal economic conditions, 1-3 banks controlling 6-35% assets of the whole financial system are adjudged significantly unstable. In scenario 2 (bad economic conditions), a minimum 3 and maximum 8 banks controlling more than thirty percent (32-50%) assets of the financial sector are assessed significantly unstable i.e. by its estimated NPL/advance surpassing equity advance by significant margin. In scenario 3 (worst economic conditions), during 1998 - 2001, a minimum 3 and maximum 10 banks are appraised significantly unstable i.e. by its estimated NPL/advance surpassing equity advance by significant margin. These banks were in possession of 45-62% assets of the financial sector during that period.

- The second phase covers the three years period from 2002 -2004. During this phase minimum two and maximum five banks controlling more than twenty percent (22-44%) assets of the financial sector are assessed unstable i.e. by its estimated NPL/advance surpassing its equity advance. However, when we take into account the significance of the values of the estimated NPL/advance minus equity advance, authentication of the conclusion becomes difficult. The difference is caused by assessing Habib Bank unstable but not by significant margin. Habib Bank was in possession of more than 20 percent assets of the financial sector during this period. Results of stress testing in normal, bad and worst economic conditions also indicate the same difference. When we analyze the stability of banks ignoring the significance of the values of the estimated NPL/advance minus equity advance, the financial system is evaluated as unstable. But when we take into account the significance of the values of the estimated NPL/advance minus equity advance, the financial system is adjudged as stable during the period 2002 - 2004.

- The third phase covering the five years from 2005 to 2009 was the period in which the commercial banks and overall financial sector of Pakistan were assessed luxuriating in financial tenacity. Allied bank, being in authority of 5% assets of whole financial sector was the only bank adjudged financially fragile during 2005. In the year 2006, Pakistan's financial sector sinew was adjudged at its peak with no bank assessed unstable. During 2007, only KASB bank was evaluated financially unsound. During 2008, KASB and Bank of Punjab were assessed unstable. Both these banks were respectively in control of only 1% and 2% of total assets of all sample banks. During 2009, out of 18 under review banks, a maximum of 3 banks i.e. KASB, Askari and Bank of Punjab were appraised unstable. Collectively these banks were in dominion of only 8 percent assets of the whole financial sector. As a whole assets of banks evaluated unstable remained less than 10% of the whole financial system and therefore financial system as a whole was evaluated as stable. Stress testing results also verify the conclusion. In all the scenarios i.e. normal, bad and worst economic conditions, the financial system is assessed robust enough to retain its stability during 2005-2009.
- The fourth phase (2010-2014) comprises the last five years of sample period. In this phase, Pakistan's financial sector is assessed to exhibit downturn and lose the stability it had acquired and maintained throughout 2005-09. Out of 18 sample banks a minimum 4 and maximum 7 banks were adjudicated as unstable during different years of this phase. In 2010, seven banks controlling more than 20% of the assets of under review banks were assessed unstable and therefore financial sector described as unstable. During both 2012 and 2014, KASB, Askari, Faysal and Bank of Punjab were adjudged unstable. These four banks were having ownership of 11% of the total assets of whole financial sector. However, a close look of the results indicates that the system has shown a positive trend during this phase also. As per our definition, financial system is considered stable if banks assessed unstable are in possession of less than 10 percent of the assets of whole financial system. During the four years i.e. 2011-2014, banks adjudged unstable are in possession of 11-12

percent assets of the financial system and therefore on the margin of stability. When we take into account the significance of the values of the estimated NPL/advance minus equity advance, the financial system is adjudged as stable during the period 2010-2014.

As a whole, the financial system of Pakistan has demonstrated a positive trend. Financial system is assessed 'unstable' during (1998-2004), which improved to 'less stable' in 2005 and attained the state of stability during 2006-2009. Financial system is assessed 'less stable' during 2011-2014.

When we analyze the stability of a bank (and banking system) on the basis of 'significant' values of the estimated NPL/advance minus equity/advance, then Pakistani commercial banks and overall financial system presents a different picture. During 1998-2001, in normal, bad and worst economic conditions, banks assessed significantly unstable are in control of maximum 35%, 50% and 62% assets respectively of the whole financial system. During 2002 and onward banks assessed significantly unstable are in control of maximum 6% assets of the whole financial system in normal, bad and even worst economic conditions. Thus it can be concluded that Pakistani financial system is stable since 2002 and can withstand bad and even worst economic conditions.

5.2.2 Banking System of India

The results of the study connote that in terms of stability of Indian banking system, the period 1999-2014 can be divided into four distinct phases.

The first phase is composed of first four years i.e. 1999-2002. During different years of this phase, out of 17 under review banks a total of 10-11 banks are evaluated unstable by finding its estimated NPL/advance surpassing its equity/advance. The banks assessed unstable were in possession of at least 81% (and at most 85%) of the total assets of the whole banking system. The overall banking system is thus appraised unstable during this period. However, when the banks are assessed on the basis of only 'significant' values of estimated NPL/advance minus its equity/advance, only two banks controlling 5.3 percent assets of the banking sector

are estimated unstable during 2001. No bank is adjudged unstable by significant margin during 1999, 2000 and 2002. The difference is made by the State bank of India (the biggest commercial bank in terms of assets). State bank of India is assessed unstable through the period under review i.e. by estimated NPL/advance surpassing its equity/advance. However when we assess the banks on the basis of only 'significant' values of estimated NPL/advance minus its equity/advance, State bank of India is assessed stable during this period i.e. 1999-2002. It can thus be concluded that during 1999-2002, Indian banking system was on the borderline between stability and instability.

The second phase encompasses only two years of 2003 and 2004. Twelve banks are assessed unstable in terms of its estimated NPL/advance surpassing its equity/advance. The banks evaluated unstable were in control of more than 88 percent assets of the banking system of India. Results of evaluation of stability of banks on the basis of only 'significant' values of estimated NPL/advance minus its equity/advance also support this conclusion by finding two banks controlling more than 34 percent assets of banking sector unstable.

The third phase comprises the period of 2005-2013. The state of stability of banking system of India is similar to that of the period of 1999-2002. A minimum number of 3 and maximum 14 banks are adjudged unstable during this period on the basis of its estimated NPL/advance surpassing its equity/advance. These banks estimated unstable had clout on more than 40 percent (42-88%) assets of the banking sector of India during 2005 - 2013. Results of assessing the stability of the banking system on the basis of only 'significant' values of estimated NPL/advance minus its equity/advance however, does not authenticate this finding. No bank is evaluated unstable by significant margin during 2005-2008 and 2011-2012. Only one bank is estimated unstable by significant margin during 2009, 2010 and 2013. These estimated unstable banks are in possession of 3-4 percent assets of the banking sector of India. It can thus be concluded that during 2005-2013, Indian banking system had a doubtful stability.

The fourth phase covers the year 2014 only. The year 2014 is assessed the worst year in term of financial stability for the Indian banking sector. The estimated

NPL/advance of 14 (out of 17) banks are assessed surpassing its equity/advance during the year. The banks adjudged unstable were in control of 84 percent assets of the Indian banking sector. Results of assessing the stability of the banks and banking system on the basis of only 'significant' values of estimated NPL/advance minus its equity/advance also support this finding. Six banks controlling 30 percent assets of the banking system are evaluated unstable by significant margin. During the period under review i.e. 1999-2014, the number of banks evaluated significantly unstable is maximum during 2014.

5.3 Some Noteworthy Findings of the Study

5.3.1 Noteworthy Findings of the Study (Pakistan)

- An interesting conclusion of the analysis is that during 1999-2004, big banks like Habib bank, Muslim commercial bank, Allied bank and United bank were unstable. After 2004, these banks improved its financial health and are assessed stable. However small banks like KASB, Bank of Punjab, Askari and Faysal banks started experiencing financial difficulty after 2004.
- Citibank, Deutsche Bank and Standard Chartered bank are assessed stable throughout 1998-2014.
- A positive aspect of the Pakistani banking sector is that the six biggest banks i.e. Habib bank, National bank, United bank, MCB bank, Allied bank and Bank Alfalah, controlling 70% of the assets of banking system, are assessed stable since 2006.
- Two banks i.e. Bank of Punjab and KASB banks are estimated unstable i.e. by its estimated NPL/advance surpassing its equity advance by significant margin during 2011-14. These banks were in possession of 4.7% assets of the banking system. Bank of Punjab is adjudged unstable but not by significant margin during 2014. KASB Bank has already been merged with BankIslami in May 2015.

5.3.2 Noteworthy Findings of the Study (India)

- Almost all public sector banks reviewed are adjudged unstable during 1999-2005, exhibited signs of recovery during 2006-2011 but adjudged markedly unstable during 2012-14.
- Although Axis bank and HDFC bank are estimated significantly unstable during 2009 - 2010 and 2014 respectively, these three private sector banks are evaluated to have performed satisfactorily specially during the last four years of the period under review.
- The instability of the Indian banking system in 2014 is more noteworthy when six banks possessing 30% assets of the banking system are appraised unstable by significant margin. The number of banks adjudged significantly unstable is (maximum) two during 1999-2013 but abruptly increases to six in 2014.
- During 2014, twelve (out of total thirteen) public sector banks are evaluated significantly unstable in bad economic conditions i.e. its NPL/advance surpassing its equity/advance by significant margin.
- State Bank of India which is the biggest bank (in terms of assets), is the only bank assessed unstable throughout the period under review.
- Results of the stress testing of the banking system of India under various scenarios denote that Indian banking system lacks the potential to withstand any macroeconomic shocks. In any significant adverse macroeconomic conditions, the system is expected to collapse.

5.4 Directions for Future Research

- ✓ Analysts other than IMF and Central Banks' staff have not appraised financial sectors of Pakistan and India comprehensively. Studies made so far have restricted its scope to a specific group of banks. Stability of individual banks

has not been evaluated. These studies have used macroeconomic and bank level factors for its clout on non-performing loan ratios of banks and then using estimated non-performing loan ratios as a yard stick for evaluating the stability of banks. Some of the expected implications of this study are as following:-

- This study has for the first time taken equity position of the concerned financial entity vis-a-vis its NPL Ratio. It is expected that future studies appraising stability of financial entities will take equity position into account.
 - So far only IMF and Central Banks staff have used the techniques of stress testing and scenario analyses for adjudging the stability of financial entities and its robustness to withstand shocks. This is the first by analysts other than IMF and Central Banks' staff, stress testing and scenario analyzing the stability of the banks and overall banking systems of Pakistan and India. It is therefore, expected that analysts other than IMF and Central Banks' staff, will start using techniques of stress testing and scenario analyzing for assessing stability of the banks and overall banking systems.
 - Process of stress testing provides ample freedom to analysts to select risks and severity of scenarios. It is therefore, expected that analysts other than IMF and Central Banks' staff will assess stability of the financial and banking systems (including those of Pakistan and India) varying the risks and severity of scenarios.
- ✓ Following results/conclusions of this study require further investigation and confirmation.
- For Pakistani banking system, the study concludes that during 1999-2004 (first six sample years), big banks like Habib bank, Muslim commercial bank, Allied bank and United bank were unstable. After 2004, these banks improved its financial health and are assessed stable during the remaining sample period (2005-2014). Small banks like KASB,

Bank of Punjab, Askari and Faysal banks on the other hand have been adjudged started experiencing financial difficulty after 2004. This conclusion requires further investigation to confirm these results and to see whether it is only size of a bank responsible for stability or some other factors have caused the change in stability after 2004.

- Three foreign banks i.e. Citibank, Deutsche Bank and Standard Chartered bank were included in sample banks for Pakistan and one foreign bank i.e. Citibank was included in sample banks of India. All these were assessed stable throughout the sample period not only in normal and non-stressed economic conditions but were adjudged robust enough to withstand even worst economic conditions. Foreign banks functioning outside their country of origin, take conservative approach, by keeping Capital adequacy ratio approximately 2% higher than local banks. In addition to that, there is no pressure from local authorities for advancing loans to certain sectors or firms. This finding also needs further investigation to confirm and to check for any procedural mistakes for inclusion of foreign banks in sample.
- Private sector banks have been adjudged out performing public sector banks in Indian banking system. The conclusion requires confirmation and if confirmed, consideration on part of Indian center and state governments for privatization of banks under their control.

5.5 Recommendations

Based on the findings of our study, following suggestions and recommendations are made:-

- ✓ Central banks carry out stress test and scenario analysis of the financial institutions under its purview. However, they withhold its details especially about the 'fragile' institutions. As per Article VIII of the Articles of Agreement of the IMF, member countries cannot be compelled to share data of

financial institutions with IMF staff for analyses. In some cases, authorities have outrightly refused to provide any data. Even if a member country provides all data, IMF staff cannot share findings of its analyses, unless agreed by the concerned country. As an average, more than half of the member countries do not allow publishing all the details of stress test conducted under financial system assessment program. A major argument presented in defense of holding information about weak financial entity is ‘to avoid undue alarm’ and ‘panic withdrawal’. However, this confidentiality creates a false sense of security, discredits their reports and is tantamount to deprive its stakeholders of their right of information. It is therefore, recommended that:-

- Regulators (Central Banks) should revisit its policy of withholding information. Timely dissemination of all the data about each and every financial institution will keep top management of all banks vigilant and watchful, and thus striving for efficiency. It will also help in controlling unethical practices like ‘insider trading’ etc.
 - Despite withholding information, Central Banks should help banks (under its purview) improve its risk management techniques and liquidity/equity positions.
- ✓ Private sector banks have been adjudged out-performing public sector banks in Indian banking system. Indian centre and state governments should consider privatization of public sector banks. If complete privatization is not viable, then at least partial privatization may be made by selling a certain percentage of shares and transfer the management of banks to private shareholders.
- ✓ Independent researchers (analysts other than IMF and Central Banks’ staff) should start using techniques of stress testing and scenario analyzing, selecting the risks and severity of the scenarios as per the existing environment of the financial entities being reviewed.

- ✓ NPL ratios and equity position is not the only factor gauging the resilience of financial entities. Other factors like liquidity positions and provisions for NPL also give strength to banks for absorbing shocks of growing NPL. Analysts are therefore expected to expand the scope of their analyses by taking into account the role of variables like equity position, provisions for NPL etc.
- ✓ Cost of capital is high in Pakistan and India. The study confirms that interest rate spread (in Pakistan) and interest rate (in India) have significant positive impact on non-performing loans of banks. It is suggested that concerned authorities may take measure to bring the rate of interest down. It will help improving the stability of banks and banking system and will also have a salutary effect on productivity of businesses, real income and GDP of these countries.

5.6 Contribution of the Study

Contribution of the study is as following:-

- This study is first attempt by independent analysts (other than IMF and Central Bank' staff) to appraise the 'state of solvency' of individual commercial banks and whole banking sectors.
- This study is the first attempt by independent analysts, assessing stability of individual banks and overall banking sectors of Pakistan and India by taking equity position vis--vis NPL ratios
- This is the first attempt by independent researchers to stress test and scenario analyze a bank and overall banking sector, for it's tenacity to absorb macroeconomic shocks.

5.7 Limitations of the Study

- Pakistan has not experienced financial crisis due to some shock/contagion, therefore stress events and its impact on macroeconomic indicators are not included in the design.
- Past studies do not provide any insight for terming a bank stable or unstable on the basis of comparing NPL and equity ratios. Past studies also do not provide any definition for terming a banking system stable or unstable on the basis of ratio of assets controlled by unstable banks. Operational definitions were therefore introduced for this study.

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