2 DIMENSIONS OF MONETARY AND FINANCIAL STABILITY

Central banks across the globe are responsible for maintaining price (or monetary) stability as their foremost objective, along with safeguarding the stability of the financial system, whether or not they directly regulate and supervise the financial sector. Two debates which generally exist regarding these primary objectives relate to: a) the nature of the formal mechanism required to monitor and maintain financial stability; and b) whether these objectives are closely aligned or entail a trade-off in the associated policy-response. This chapter aims to capture the essence of both these debates in the context of Pakistan.

Part A discusses the theoretical and practical considerations in proposing a forward-looking framework for financial stability at SBP, while Part B focuses on the extent to which the objectives of monetary and financial stability are closely aligned in case of Pakistan.

A. FRAMEWORK FOR FINANCIAL STABILITY

While there is a broad consensus on the parameters of a formal framework for monetary policy,[1] the framework for maintaining financial stability is still evolving, largely because of the lack of consensus on the varying institutional structures for banking supervision and central banking functions around the world. Notwithstanding, central banks will always remain concerned with, and directly involved in, the pursuit of financial stability given their responsibility of maintaining price stability and oversight of the payment system. Monetary and financial stability are closely linked, not in the least through the Lender of last resort (LoLR) function. Since monetary policy transmission signals work through the channels of financial markets and bank-based intermediation, this link is even more crucial. It is also a widely held view that there is no institution, besides the central bank, that can create liquidity quickly in a crisis.[2] This point was particularly demonstrated in the case of the run on Northern Rock[3] in September 2007, which has generated a debate on whether financial sector regulation through a separate, stand-alone supervisory body can indeed act to prevent a systemic crisis when called upon to do so.

Another point of divergence from the prevalent monetary stability regimes is that the objective of safeguarding financial stability does not have a single purpose which can be attained with a specific set of instruments. While there is a broad agreement on the need to safeguard and maintain financial stability, the mechanism through which it is implemented varies across geographical boundaries. Again, as opposed to monetary stability, there are no specific *drivers* or *tools* that a central bank can use to ensure its continued presence. The proliferation of Financial Stability Reports (FSRs) in the last few years shows that central banks use these publications as an important external communication tool on matters pertaining to financial stability.[4]

Not surprisingly then, there is no single accepted definition of financial stability that can be used to develop a robust framework; various central banks have adopted their own definitions as detailed in **Box 2.1.** Despite the nature of complexities involved in the process, the significance of a formal mechanism for safeguarding and ensuring the stability of the financial system is irrefutable. The focus of this formal mechanism for financial stability assessment is on identifying the sources of vulnerabilities in the financial system which can lead to potential risks, and the channels through which these risks are propagated, such that pre-emptive policy actions can

[1] The choice of a specific monetary policy regime through which the framework is implemented, varies across central banks.
[2] Goodhart (2007).
[3] UK-based mortgage finance institution.
[4] Cihak (2006) gives a consolidated analysis of the various FSRs issued by central banks in "How do central banks write on Financial Stability".

either minimize the occurrence of such vulnerabilities, or ensure an optimal level of preparedness to address them when they do.

Box 2.1: How do Central Banks Define Financial Stability?

ECB (Financial Stability Review, June 2008): Financial stability can be defined as a condition in which the financial system – comprising of financial intermediaries, markets and market infrastructures – is capable of withstanding shocks and the unraveling of financial imbalances, thereby mitigating the likelihood of disruptions in the financial intermediation process which are severe enough to significantly impair the allocation of savings to profitable investment opportunities.

Deutsche Budesbank (Financial Stability Review, 2005): Financial stability is defined as the financial system's ability to perform its key macroeconomic functions well, including in stress situations, and during periods of structural adjustment. This embraces the efficient allocation of financial resources and risks as well as the provision of an efficient financial infrastructure.

Czech National Bank (CNB) (Financial Stability Report, 2007): The CNB defines financial stability as a situation where the financial system operates with no serious failures or undesirable impacts on the present and future development of the economy as a whole, while showing a high degree of resilience to shocks.

Norges Bank (Financial Stability Report, December 2007): Financial Stability implies that the financial system is robust to disturbances in the economy and can channel capital, execute payments and redistribute risk in a satisfactory manner.

2.1 Financial Stability: Methodological Framework

Generally, ensuring financial stability depends on effective financial regulation which aims to provide the right incentives for prudential conduct and risk behavior by financial institutions. The primary objective of financial stability policies and assessment is to provide early warning signals in order to help in crisis prevention as distinct from crisis mitigation. Stability of the financial system benefits and promotes: (i) smooth and efficient financial intermediation processes that allocate savings to lucrative investment opportunities, (ii) a relatively balanced development of different segments of the financial system, and (iii) proper transmission of monetary policy signals, whose effective conduct and implementation in turn facilitates price stability. Price stability and financial stability tend to mutually reinforce each other in the long run.

Keeping in view these considerations, most countries have developed elaborate frameworks designed to measure, monitor and safeguard financial stability. A number of advanced countries have also adopted sophisticated models to conduct macroeconomic and financial sector surveillance. Developing countries, however, due to data limitations and the size and structure of the financial sector, have simpler frameworks for the assessment of financial stability. Given its broad and subjective nature, and the lack of a single indicator or tangible instruments to gauge the extent and degree of financial stability, these models employ varying quantitative techniques, and a standardized approach is expected to evolve as a result of these efforts. Again, in contrast with monetary stability, it is much more difficult to *model* financial stability (**Box 2.2**).

Academic research and international best practices adopted by the leading central banks in this area bring forth some key elements for financial stability assessment: (a) a focus on a small number of key vulnerabilities in the financial sector, (b) a systematic and analytical approach to assessing these vulnerabilities, including a broad-based attempt to assess their materiality in terms of probability and impact, and (c) an assessment of policy actions that might be undertaken to mitigate their potential impact.[5]

[5] As elaborated in Bank of England's Financial Stability Paper No. 2, April 2007.

Box 2.2: **Modeling Financial Stability**
Given the inherent difficulty in arriving at a single measure of financial stability, a term which encompasses the soundness of a wide array of institutions, markets, and infrastructure mechanisms, central banks and academic researcher around the world are in various stages of progress in developing a scientific model for ensuring and maintaining financial stability.

Discussed below are two such attempts to do so:

Probability of Default (PD) and Loss Given Default (LGD)
In particular, Goodhart and Tsomocos (2007) state that financial (in)stability is generated by the probability of default (PD) and bankruptcy. This then necessarily implies that economic agents are heterogeneous; something that most mainstream economic models fail to take into account. An assessment of the probability of default is linked to the uncertainty generated by lack of information as to when depositors may need to withdraw their money from a bank (as discussed in Diamond & Dybvig (1983) and Allen & Gale (2007)). In this approach, insolvency derives from illiquidity. This is in contrast with other approaches, where default arises from a decline in the value of bank assets, for instance from credit or market risk. The main uncertainty in this latter genre is about the value of bank assets, i.e. insolvency rather than illiquidity.

However, a problem in modeling such causes of systemic risk is that incorporating PD and LGD into a theoretical model is difficult, since default is, by definition, a discontinuity. However, not only is the probability of default (PD) a key concept in any analysis of financial fragility, it is also central to the Basel II framework.

Contingent Claims Analysis (CCA)
Contingent Claim Analysis, also known as the Merton model, is a generalization of the 'option pricing theory' to the analysis of financial stability, and in particular, credit risk. A contingent claim is any financial asset whose future payoff depends on the value of another asset. The option--the right to buy or sell the underlying asset at a pre-specified price and expiration date--is the best known contingent claim. CCA provides a framework for the analysis of mismatches between an entity's assets and liabilities, such that policies or actions which reduce these mismatches will also help reduce risk and vulnerability. The CCA approach appears promising, as it allows for a clear quantification of default risks. However, it does not explicitly model the behavior of economic agents.

Source: 1. Analysis of Financial Stability by C.A.E. Goodhart and D.P. Tsomocos, presented in the Bank of Canada Annual Conference on "Developing a Framework to Assess Financial Stability", November, 2007.
2. Modeling Financial Instability, Franklin Allen, National Institute Economic Review No. 192, April 2005.
3. A New Framework for Analyzing and Managing Macro-financial risks of an Economy, Gray, Merton and Bodie, Working Paper No. 07-026.

2.2 SBP's Existing Framework for Financial Stability Assessment

The mandate for maintaining financial stability in Pakistan rests with the State Bank of Pakistan (SBP) in its capacity as the central bank and the regulator of the banking sector.[6] State Bank of Pakistan views its objective of safeguarding financial stability in the context of smooth and efficient financial intermediation, encompassing financial institutions, financial markets and the financial infrastructure, such that the process can withstand disruptions caused by internal and external events, and potential threats and risks are managed with the objective of minimizing systemic risk.

As part of its financial stability assessment mechanism, SBP also undertakes an independent review of the Non-Bank Financial Companies (NBFCs), the Insurance sector, Pension Funds, and Capital Markets, though these segments of the financial sector are under the oversight of the Securities and Exchange Commission of Pakistan (SECP).[7]

Given this division of regulatory responsibilities, SBP's existing framework for financial stability assessment is primarily focused on the stability of the banking system. In terms of organization, the assessment is undertaken as a shared responsibility within the central bank: the Banking

[6] SBP also regulates and supervises Development Finance Institutions and Foreign Exchange Companies.
[7] The regulation of the Insurance sector is a joint responsibility with the Ministry of Commerce.

Policy and Regulation (BPR) group[8] undertakes policy formulation on the basis of the off-site surveillance of the banking sector in monitoring developments and keeping an active dialogue with banks. The Banking Supervision group,[9] on the other hand, undertakes both off-site enforcement and on-site inspection. The newly established Financial Stability Department (part of the Monetary Policy and Research group) is mandated to independently assess financial stability from a policy-formulation and research perspective, and is also responsible for preparing the annual Financial Stability Review (FSR) and for developing a macro-prudential framework for financial stability.

A brief discussion of various components of the existing framework is given below:

2.2.1 Off-Site Surveillance and On-Site Supervision

SBP follows a well developed framework for the off-site surveillance and on-site supervision of banks and DFIs. In doing so, it makes use of the CAELS (Capital Adequacy, Asset Quality, Earnings, Liquidity and Sensitivity) rating system for the off-site monitoring of banks and DFIs as a key component of its supervisory and stability framework. This system encompasses a temporal and cross-sectional analysis of financial ratios. The exercise not only helps in identifying key risk areas of banks and DFIs, but also in the efficient use of scarce on-site supervisory resources. The analysis of CAELS ratios for the (aggregate) banking system is periodically published in the Quarterly Performance of the Banking System (QPR)[10] and annually in the Financial Stability Review (FSR).[11]

For the on-site inspection of banks, SBP uses the CAMELS-S framework (Capital Adequacy, Asset Quality, Management, Earnings, Liquidity, Sensitivity and Systems & Controls) on a regular basis. The key ratios for each component of the framework and their respective benchmarks are specified in the SBP On-site Inspection Manual. The CAELS framework referred to above, used for off-site surveillance of banks, is a sub-set of the CAMELS-S framework.

Another important component of this overall stability assessment is the Institutional Risk Assessment Framework (IRAF). The IRAF assigns scores to individual institutions based on: (1) the qualitative assessment of compliance with standards, codes and guidelines, (2) assessment of supervisory and regulatory information, (3) financial performance and condition, and (4) market information and intelligence. IRAF serves as an early warning tool of potential risks in the banking system and is discussed in detail in **Box 2.3**.

2.2.2 Stress-Testing

Another notable component of the existing framework is the stress testing exercise conducted on the periodic data received from banks. Stress testing refers to a set of quantitative techniques used to assess the vulnerability of the financial system to exceptional but plausible shocks. Generally, stress testing involves five steps namely: (1) identifying major risks and exposures in the financial system; (2) collecting relevant data; (3) developing scenarios or shocks to be applied; (4) deciding and implementing the methodology for stress testing; and (5) calibrating the effect of shocks to the capital, assets and/or profitability of the financial system or individual institutions.

[8] This includes 4 departments i.e. Banking Surveillance Department (BSD), Banking Policy and Regulations Department (BPRD), Consumer Protection Department (CPD) and the Islamic Banking Department (IBD).

[9] This includes 2 departments, i.e. the Banking Inspection Department (BID), and the Off-site Supervision and Enforcement Department (OSED).

[10] Quarterly publication of the Banking Surveillance Department, available on www.sbp.org.pk.

[11] Previously this was covered in the Annual Banking System Review (BSR) and the Financial Sector Assessment (FSA) Report, both of which have been replaced by the annual Financial Stability Review from 2007.

Box 2.3: The New and Improved Institutional Risk Assessment Framework (IRAF)

In January 2004, the SBP introduced a new system of monitoring, surveillance and supervision in the form of the "Institutional Risk Assessment Framework" (IRAF) to further strengthen the existing supervisory mechanism. The main objective of IRAF is to ensure a cohesive and proactive monitoring of the risks that banks and DFIs (i.e. financial institutions under the regulatory ambit of the SBP) are exposed to. The framework envisages a collaborative and seamless supervisory focus amongst various supervisory departments within SBP. Based on an automated system, the framework provides timely flow of information and enables SBP to effectively implement the process of banking supervision. It also ensures continuous monitoring both on the part of the SBP and the institutions themselves, integrating off-site surveillance, on-site examination and current market information.

The system includes four kinds of inputs based on which banks and DFIs are evaluated. These include compliance with standards, codes and guidelines; supervisory and regulatory information; financial performance and condition and market information and intelligence. The required input for this purpose flows from both the internal as well as external stakeholders. The external stakeholders include the financial institutions, external auditors, credit rating agencies and other formal and informal sources of market information. The original weights assigned to these components in the overall assessment were 20, 25, 40 and 15 respectively. In light of feedback from the stakeholders, SBP has reviewed the existing framework and these weightages, as discussed below:

(1) Compliance with Standards, Codes and Guidelines: Information in this component is based on a bank's compliance with the standards and codes as adopted under Pakistan's laws and regulations, SBP's regulatory and statutory requirements, code of corporate governance and risk management guidelines and instructions for sound business and financial practices. For this, SBP has prepared and circulated self-assessment questionnaires in accordance with the relevant laws and rules & regulations. These questionnaires are comprehensive in nature and designed to capture the level of compliance in wide ranging areas including corporate governance, internal controls, risk management and Prudential Regulations. Banks are required to respond to these questionnaires and submit a half yearly report, duly endorsed by their Board of Directors. Based on this self-assessment compliance report, the bank is rated on a scale of 1 to 5 for each major category and this then feeds into the *Compliance Risk Rating (CRR)***.** This report is validated during the on-site inspection by the Banking Inspection department (BID) and carries an aggregate weightage of **15.0** percent in the overall IRAF rating. The framework not only provides an opportunity to the financial institutions to carry out self-appraisal through the IRAF questionnaires, but also indicates the gap, if any, in compliance with SBP regulations.

(2) Supervisory and Regulatory Information: This component is based on the assessment of Management and Systems & Controls. Findings of on-site inspection by the BID, information related to frauds and forgeries from the Banking Policy & Regulations Department (BP&RD), management letter from external auditors, and compliance status on SBP instructions compiled by the Offsite Supervision & Enforcement Department (OSED) are the major inputs for this component. This assessment results in a composite rating on a scale from 1 to 5 and carries an aggregate weightage of **30.0** percent.

(3) Financial Performance and Condition: This component is based on the CAMELS-S rating of BID's On-site Inspection Report, except Management and Systems & Control Components which are already accounted for in the component discussed above. Performance of the bank on the basis of audited accounts, and the CAELS rating assigned by OSED, are the other sub components of this part of IRAF. This component carries an aggregate weightage of **45.0** percent.

(4) Market Information and Intelligence: Input for this component consists of information received from credit rating agencies, volume of complaints, media press reports etc. All this information culminates in a composite Market Information Risk Rating (MIRR*)* on a scale of 1 to 5, and carries an overall weight of **10.0** percent.

Based on the above-mentioned four inputs and information on macroeconomic conditions and financial sector development, an institutional profile is prepared and an overall composite rating is assigned to each institution. In case of serious concerns or poor ratings, institutions are kept on a watch-list and required corrective actions are accordingly taken. Nature of corrective action depends on the impact of the identified weaknesses. Depending on the nature of the problem, corrective action can range from only a simple discussion with the management of a bank or DFI, to a well-defined and time bound corrective action plan to be implemented by the institution for addressing the identified weakness, followed by adequate penal actions if necessary.

The whole process provides a continuous and updated system of offsite supervision and, therefore, augments SBP's capacity to proactively monitor vulnerabilities of banks and DFIs to various risks, arising from different factors.

Source: OSED Circular No. 2 dated December 12, 2008, State Bank of Pakistan

In recent years, SBP has started to conduct stress testing for all banks on a quarterly basis, the aggregate results of which are published in the QPR of the banking system and the FSR. SBP has also issued guidelines on stress testing for commercial banks in Pakistan to enable them to formulate requisite frameworks for the proactive management of risks.[12] The process is currently based on single factor sensitivity analysis, with subsequent refinement and enhancement of scope in process to cover multi-factor scenario analysis at a later stage.

2.2.3 Financial Soundness Indicators (FSIs)

FSIs are the most widely used set of indicators used to monitor: (a) the performance of the financial system; (b) financial system's vulnerability to various shocks; and (3) its capacity to absorb losses stemming from the shocks identified. The analysis of FSIs usually includes the examination of temporal and cross-sectional variation in the indicators and comparative analysis with peer groups. The core set of banking sector FSIs is grouped according to the CAMELS framework. These FSIs are used to quantify information related to the stability or vulnerability of the banking sector.

2.3 Proposed Framework for Financial Stability

SBP's existing framework for financial stability assessment primarily relies on an integrated analysis of CAMELS-S and CAELS ratios, FSIs, IRAF and single-factor stress-testing procedures to assess the performance and stability of the banking system. All of these approaches are based on the use of historical data. However, a coherent and structured framework for the assessment of financial stability in the current era of financial globalization and integration is essentially based on a more forward-looking approach. Such a framework especially takes into account feedback effects from the macroeconomic environment, as undertaken in quantitative techniques such as macro stress testing. This process generally involves: (a) analyzing macroeconomic and financial market developments; and (2) macro-prudential surveillance.

2.3.1 Analyzing Macro-financial developments through Early Warning Systems (EWS)

The analysis of macroeconomic and financial market developments provides a forward looking assessment of the financial system. The most widely used quantitative tool for such an assessment is termed as the Early Warning System (EWS). EWS generally consolidate a number of factors that can potentially cause a financial crisis, into a single measure. Although the ability of EWS to forecast financial crisis is debatable, given their tendency to generate potentially false alarms as well as 'near-misses', these models still serve as a useful tool to predict impending crisis. Two approaches i.e. the *indicator approach* and the *limited dependent variables* models are used to develop EWS. The IMF also uses both these approaches, especially for developing countries, however the focus of their EWS is on currency crisis.[13] Various central banks and global financial institutions have also developed EWSs as a key component of their financial stability framework.

Work on developing an Early Warning System at SBP encompasses the identification of various financial indicators, which would then be used to develop a model based on the indicator approach. This will then be taken to the next level of sophistication by developing an EWS based on the limited dependent variable techniques.

2.3.2 Macro-Prudential Surveillance

Macroprudential Surveillance i.e. the monitoring of structural trends in financial markets so as to give warning of impending financial *instability*, reinforces the concept of EWS as it also "tries to

[12] BSD Circular No. 5, dated October 5, 2005.
[13] Davis and Karim (2007).

assess the health of the financial system and its vulnerability to potential shocks".[14] The quantitative tools widely used for macro-prudential surveillance include Financial Soundness Indicators (FSIs) and Stress Testing. In addition to these, macro-prudential surveillance also makes use of qualitative methods to gauge the quality of the legal infrastructure, and the regulatory and supervisory framework.

Strengthening analysis of Financial Soundness Indicators (FSIs): In order to undertake *micro-prudential* surveillance, the existing analysis of FSIs is proposed to be strengthened by including various indicators from the IMF's 'encouraged set"[15] of indicators. Moreover, FSIs for non-bank financial institutions are also proposed to be identified and monitored. A Financial Soundness Index, initial work on which was part of FSR 2006,[16] will supplement this analysis.

Macro Stress Testing

The suggested framework proposes to enhance the scope of the single factor sensitivity analysis by taking forward the framework for macro stress testing, as discussed in the **Special Section: Framework for Macro Stress Testing**, at the end of this chapter. Work on identification of risk transmission mechanisms and the quantification of identified *financial stability transmission channels* will be the major areas of research at SBP in the coming years. However, the process is likely to be slow due to issues related to data limitations.

Modeling Financial Stability

In the absence of a well established comprehensive framework for modeling financial stability, the Financial Stability Department has initiated research on the various approaches deployed by various central banks for modeling financial stability, using the available data stream. This work will include the identification and quantification of various channels of the financial stability transmission mechanism.

Understanding the channels of risk propagation - Analysis of Macro-financial Linkages

Analysis of the risk transmission mechanism in the financial sector helps in identifying the most affected parts of the financial and the non-financial sectors in the wake of potential shocks, by identifying the sources of stress in the system. Moreover, the analysis also helps in understanding the second-round feedback effects of potential shocks. This is generally done by developing a theoretical framework for the risk propagation mechanism, which clearly identifies the possible channels through which the financial and non-financial sectors of the economy interact with each other. The most crucial part is the quantification of these channels, which is at the heart of translating the impact of various shocks on different sectors.

Compared to the detailed analysis of the transmission mechanism, partial analysis aimed at exploring macroeconomic and financial linkages is also widely used in financial stability analysis. Specifically, the estimation of the dependence of the non-financial sector on the financing provided by the financial sector, the effect of banking sector performance on the transmission mechanism of monetary policy, debt sustainability of households, corporate entities and other sectors of the economy are some of the important linkages, which are estimated by using various econometric techniques. The quantification of various transmission channels and linkages in the previous step leads to calibrating the effects of various shocks on the bottom-line indicators. The results are interpreted such that associated risks are highlighted.

[14] The World Bank and IMF (2005).

[15] A detailed list of FSIs is divided into 'core set' and 'encouraged set' of indicators depending on the importance of the indicators and availability of the data. For details, see The World Bank and IMF (2005).

[16] Chapter 6, Stability of the Banking System, Financial Stability Review 2006, State Bank of Pakistan.

2.3.3 Conclusion and Policy Actions

A formal framework for the assessment of financial stability paves the way for possible policy actions (when required) to ensure efficient and smooth functioning of the financial system. The proposed framework is at the initial stages of development, and the process and components are expected to evolve over a period of time. The framework will be subjected to ongoing refinement in response to the dynamics of a rapidly evolving and expanding financial sector. For instance, as the level of integration of Pakistan's economy and financial sector with the global financial system increases, there would be the need to develop a separate modular mechanism for the assessment of risks emanating from domestic and external developments.

B. MONETARY AND FINANCIAL STABILITY

Global inflationary pressures in the 1970s paved the way for the development of a credible institutional set-up which has served to prevent monetary instability over the past three decades. The most notable development on this front is the increasing independence of central banks with a clear mandate for maintaining price stability. Subsequently, the 1980s saw the emergence of financial stability concerns in the wake of financial crises in Latin American countries around 1980, Nordic countries in the late 1980s and East Asian countries in late 1990s.[17] The subsequent juxtaposition of these two goals of a central bank i.e. monetary and financial stability has generated considerable debate among policy makers and academic researchers as to whether these objectives are aligned in terms of the required policy response or entail a trade-off. Suffice to say that the debate is yet to be resolved in the absence of strong empirical evidence.[18] Notwithstanding, monetary and financial stability are closely related, if not inextricably intertwined.[19]

Given the legal mandate of SBP 'to secure monetary stability and soundness of the financial system',[20] this section provides perspectives on the links between monetary and financial stability. In doing so it also discusses the relevance of this issue for the conduct of monetary policy in Pakistan, and potential policy implications.

2.4 Monetary and Financial Stability: The Conventional View

Bordo et al (2000) summarize the conventional view of the links between monetary and financial stability in stating that "results indicate that a monetary regime that produces aggregate price stability will, as a by-product, tend to promote stability of the financial system". Conventional wisdom does not recognize any significant trade-off between the objectives of monetary and financial stability of a central bank as inflation is one of the key determinants of financial stability.[21] The proponents of this view argue that high and volatile inflation (also referred to as monetary instability) distorts price signals, aggravates asymmetric information problems for both lenders and borrowers, affects asset prices on the balance sheets of financial institutions, redistributes wealth among economic agents and significantly shortens investment horizons. Schwartz (1988 & 1995) also concludes that a regime of monetary and price stability is the route to financial stability. This implies that price stability is not only a necessary condition for maintaining financial stability, but *almost* a sufficient condition also. This is also known as the '*Schwartz Hypothesis*' in literature. While other academic researchers have generally refrained

[17] Borio and Lowe, 2002.
[18] Issing, 2003.
[19] Fell and Schinasi (2005).
[20] Section 9A, State Bank of Pakistan Act, 1956.
[21] Schwartz (1995) noted that a global increase in bank failures during the 1970s and 1980s was accompanied with price level instability. Jonung (1994) argues that a disinflationary monetary policy followed by Sweden and Finland during 1989 paved the way for financial instability in subsequent years. Similarly, Cargill, Hutchinson and Ito (1997) argue that Bank of Japan's tight monetary policy, in a bid to control asset price inflation, contributed to financial distress in the early 1990s.

from pronouncing a final verdict on the subject, they do still support the argument that price stability helps in maintaining financial stability.[22]

The conventional view is quite simple and easy to understand, and carries with it empirical backing. Bordo and Wheelock (1998), using historical data of US, UK and Canada, conclude that "price level instability also contributed to financial instability historically". Another detailed study on the subject by Bordo et al (2000) using US data, found that "price level shocks contributed to financial instability during 1790-1933, and that inflation rate shocks contributed to financial instability during 1980-97". Moreover, Issing (2003) notes that "most banking crises occurred during recession, often following periods of high inflation."

While the empirical evidence clearly suggests that price stability is a necessary condition for maintaining financial stability, its role as a *sufficient* condition (as suggested by Schwartz) is not widely accepted. Recurring emergence of financial imbalances[23] in an environment of stable prices, as seen most recently in events leading up to the 2007 (and ongoing) financial crisis in the US, seriously undermines the importance of price stability as a sufficient condition for financial stability.

Financial crises in the United States during the 1920s and 1990s, and Japan in the late 1980s, are widely used examples of financial instability in an environment of stable prices. To quote Crockett (2003) "low inflation has not proved to be a guarantee of financial stability". The author further notes that the cost of banking crises in terms of output loss has not decreased in periods of low inflation compared with periods of high inflation. These issues are further complicated by the choice of the monetary policy regime. A monetary policy with an objective of strict inflation targeting over a horizon of one to two years may not always be an optimal strategy due to the inherently limited horizon for forecasting inflation. The presence of financial imbalances in such a situation may force central banks to follow a policy stance which would be different than what is actually required under strict inflation targeting over a short horizon.

2.5 Monetary and Financial Stability: The "New Environment" Hypothesis

In addition to the emergence of financial imbalances in a benign inflationary environment, Borio et al (2001) and Borio and Lowe (2002 & 2003), reflect on a number of structural changes in the economy, which in their view constitute a *new environment*. This is primarily characterized by: (1) low and more stable inflation under a well-established anti-inflationary credibility of central banks, (2) liberalization of financial markets, and (3) moderation of business cycles. The proponents of this view argue that observed developments reflect an interaction of changes between monetary and financial policy regimes over the past three decades. As a result, the relationship between monetary and financial stability should be reconsidered in the context of this 'new environment'. Crockett (2003) also supports this new environment hypothesis (NEH).

NEH states that low inflation does not guarantee financial stability, as the real world has witnessed the emergence of financial imbalances even in a low and stable inflationary environment. The Japanese experience of financial imbalances in the late 1980s and the South Korean experience of the 1990s are the best examples of this phenomenon in recent times.[24] In such a situation, inflationary pressures may not surface due to positive supply shocks in the economy, weak pricing power of firms due to strong competition, and expectations of low inflation. At the same time, asset prices are likely to boom due to easy access to finance on account of financial sector developments and liberalization. The anti-inflation bias of a central

[22] Bordo and Wheelock (1998).
[23] Key indicators of financial imbalances are low real long term interest rates, high levels of debt (public and private), sharp increase in asset prices i.e. for both equity and property, and external account deficits.
[24] Borio and Lowe, 2002.

bank may paint too optimistic an outlook for future economic developments. This sense of security allows economic expansion to continue by masking signs of un-sustainability. Inappropriate asset valuation ultimately results in financial imbalances in the economy. All these developments may have arguably made the financial sector more prone to booms and busts.

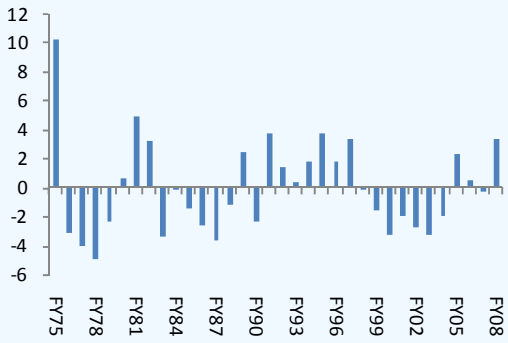
2.5.1 New Environment Hypothesis: Case of Pakistan

Before moving on to the discussion on policy implications of the NEH, it would be instructive to analyze changes in the macroeconomic environment in Pakistan with special reference to the characteristics of NEH. The analysis will also be helpful in suggesting policy recommendations, if any, for the conduct of monetary policy in Pakistan.

Inflation outlook and developments

Inflationary trends in Pakistan show that the average CPI inflation has declined, with some fluctuations seen since the second half of the 1970s (**Table 2.1**). It was at an all time low during FY00-04, with a visible decline in CPI inflation around the mean, as evident from both the standard deviation and coefficient of variation in different time periods. Variation in inflation around the long term trend (HP filter trend) has also declined slightly over the sample period (**Figure 2.1**). There is also some evidence about the stickiness of inflation over the period of analysis as the null of unit root in inflation is rejected at the 1.0 percent level of significance.[25] In simple words, this implies that increases in the rate of inflation do not seem to be permanent in nature as inflation reverts to its mean in subsequent years. All these developments jointly suggest that there is an indication that the economy is moving towards low and stable inflation, especially when compared to the second half of the 1970s. Notwithstanding, the recent surge in inflation in Pakistan and in the rest of Asia, is best interpreted as an outlier occurrence emanating from exceptional domestic and external circumstances.

Figure 2.1: Inflation Volatility Around The Trend



Source: FBS , SBP calculations

Table 2.1: Inflationary trends in Pakistan

	FY75-79	FY80-84	FY85-89	FY90-94	FY95-99	FY00-04	FY05-08
Average	12.6	9.5	6.1	10.1	9.8	3.8	9.2
Standard Deviation	8.1	3.8	2.6	2.5	3.0	0.6	2.0
Coefficient of Variation	64.5	39.6	43.6	24.7	30.4	16.3	21.2

Source: FBS, SBP Calculations

Liberalization of the Financial Sector

Broad based implementation of financial sector reforms in Pakistan dates back to 1990, when a reform program was initiated to reduce market segmentation, improve efficiency, promote competition and enhance financial deepening. Private sector participation in the financial sector was encouraged by the privatization of state-owned financial institutions and facilitating the entry of new private sector participants. The reform process has had a profound influence on the

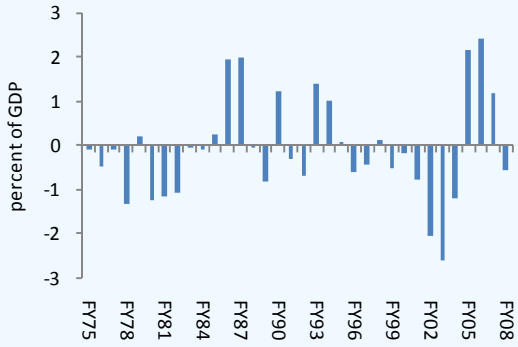
[25] Presence of unit root in inflation can be interpreted as an increase in inflation in time period t which leads to a permanent rise in inflation.

structure and functioning of the financial sector.[26] Some of the more relevant developments in terms of liberalization measures are briefly summarized here:

- The private sector has emerged as the single largest owner of the financial sector. Its' share in the overall assets of financial institutions has reached over 75.6 percent by end CY07, compared to less than 10.0 percent in CY90. Within the financial system, the banking sector holds a dominant position as its asset share in the overall financial sector is 72.1 percent. The structure of the banking sector has also witnessed notable changes since 1990. Specifically, the share of public sector banks (commercial and specialized) has declined from over 90.0 percent in CY90 to 23.3 percent by end CY07.
- Another important development is the substantial amount of foreign direct investment in the banking sector in recent years. At present foreign stake in the banking sector is 45.7 percent.[27]
- The regime of credit control and targets as announced in the annual credit plans, and directed credit towards priority sectors, has also been phased out. While indicative targets still exist for the agriculture sector, market forces now guide the allocation of credit to various sectors.
- Besides financial institutions, the reforms process has also focused on liberalizing financial markets. Specifically, foreign investment in the equity market is facilitated by the Special Convertible Rupee Accounts (SCRA). Equity investments in the stock exchange are routed through these accounts without any restriction by the central bank.

The above developments clearly suggest that the financial sector has witnessed substantial changes over the past two decades. To assess whether these developments have affected the behavior of key indicators of the NEH or not, trends in the private sector credit (PSC) to GDP ratio and asset prices are analyzed for the period spanning from FY75 to FY08. **Figure 2.2** shows that fluctuations in the PSC/GDP ratio around its long term trend have increased in recent years. Moreover, two particular episodes of increase in the PSC/GDP ratio indicate that it took 9 years for it to increase from 19.8 percent to 28.4 percent in the 1980s and just 4 years to move from 21.3 percent to 28.8 percent in FY03-FY07, suggesting rapid credit expansion in recent years.

Figure 2.2: Fluctuations in Private Sector Credit



Source: SBP calculations

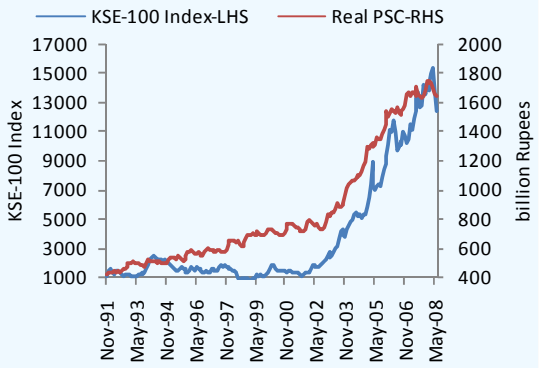
Credit expansion is also considered to be an important leading indicator of banks' performance as it increases the probability of a deterioration in credit quality in subsequent years.[28] Suffice to say, credit expansion and asset prices generally tend to move in tandem, as booms and busts in credit generally coincide with asset price bubbles and bursts. Monthly data on private sector credit and the KSE-100 Index[29] is used to check this association from 1991 to June 2008. **Figure 2.3** shows that there is a strong association between real private sector credit and the KSE-100 index, with a correlation coefficient of 0.96 over the sample period.

[26] Please see various issues of the Financial Sector Assessment (FSA) Reports, State Bank of Pakistan, for a detailed analysis of financial sector reforms.
[27] As of end June CY08.
[28] Borio and Lowe, 2002
[29] Ideally one should use both asset prices and equity prices to form an asset prices index. In the absence of data on property prices, only equity prices are used.

Moderation in Output Fluctuations

Another key characteristic of the NEH is the moderation of output fluctuations, or business cycles, over the past three decades. To analyze output fluctuations in Pakistan, annual time series data on GDP growth and output gap from FY55 to FY08 is used. Descriptive statistics of GDP growth suggest that there is a weak indication that output fluctuations have narrowed over the years (**Table 2.2**). For the output gap, estimates from Bukhari and Khan (2008) are used. **Figure 2.4** shows that the fluctuations in output gap remain within the range of 200 bps. However, there is little indication of a moderation in fluctuations.

Figure 2.3: Credit and Equity Prices



Source: SBP calculations

Table 2.2: Volatility in GDP Growth

percent

	FY55-59	FY60-64	FY65-69	FY70-74	FY75-79	FY80-84	FY85-89	FY90-94	FY95-99	FY00-04	FY05-08
Average	3.3	5.1	6.7	5.5	4.6	6.4	6.4	4.9	4.0	4.2	6.8
STDEV	1.4	2.5	2.3	3.6	2.0	1.4	1.4	2.0	1.8	2.1	1.5
CV	40.9	48.9	34.4	65.9	42.9	22.3	22.3	39.6	43.7	49.1	21.8

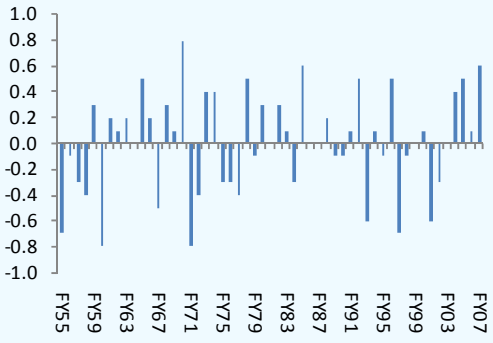
CV: Coefficient of Variation

Source: Economic Survey of Pakistan, SBP calculations

2.6 Conclusion and Policy Implications

Under conventional wisdom, a central bank's objective of maintaining price stability automatically ensures financial stability in the economy, implying that price stability is a necessary as well as sufficient condition for financial stability. This view recognizes changes in the macroeconomic environment over the past three decades, but considers these changes as unusual macroeconomic shocks. From the monetary stability point of view, this does not require any strategic change in the implementation of the policy stance. On the other hand, supporters of the NEH argue that changes in the macroeconomic environment over the past three decades are not unusual shocks, but rather that these changes constitute a new macroeconomic environment. Therefore, the strict price stability objective of monetary policy over the short horizon (1 to 2 years) should also include considerations of factors which are sufficient to ensure financial stability. For instance, it is recommended that information on financial imbalances should carry some weight in monetary policy decisions. While considerations of macroeconomic imbalances are already incorporated in monetary policy formulation, this also leads to the ongoing debate on the pro-active use of monetary policy to control asset price bubbles, which is beyond the scope of this note.

Figure 2.4: Output Gap



Source: Bukhari and Khan (2008)

As for the basic question that whether goals of monetary and financial stability are aligned or entail a trade-off, two points are worth noting. First, low inflation is not a sufficient condition to ensure financial stability, as various countries have witnessed financial imbalances in a low inflation environment. Second, low and stable inflation under a high anti-inflationary bias of a

central bank may lead to financial instability by masking inflationary pressures in the economy due to changes in the macroeconomic environment. None of these observations suggest that an unstable monetary (price) environment will contribute in any way to financial stability. Similarly, none of the proponents of the 'new environment' hypothesis have ever argued that high and volatile inflation is favorable for financial stability. The NEH simply highlights a situation of conflict in which objectives of price stability over a short to medium horizon and financial stability may be in conflict, again an occurrence most recently witnessed in the steps taken by the Fed Reserve during the financial crisis which started in 2007.

Finally, the relevance of this debate to Pakistan is assessed by reviewing changes in the macroeconomic environment of the country. Although a detailed analysis of the macroeconomic environment based on sophisticated quantitative techniques has not been undertaken, the descriptive analysis clearly shows that there are indications that, barring inflationary pressures since May 2007 or so, the economy is moving towards a relatively low and stable inflationary environment as compared to the past. Domestic bank credit has witnessed substantial rise in the recent past, also coinciding with strong increase in asset prices.[30] However, there is little evidence of moderation in output fluctuations. All this suggests that the macroeconomic environment in Pakistan exhibits some signs of a shift as envisaged by the NEH. In terms of policy implications, it may be noted that the SBP is not strictly an inflation targeting central bank in the first place. It also already takes into account the presence of financial imbalances in the economy (with potential feedback effects into the conduct of financial stability) in monetary policy formulation. Specifically, the impact of changes in indicators which are common to the conduct of both monetary and financial stability, such as interest rates, savings investment balances, credit growth, credit spreads, level of exchange rate and volatility, equity prices, sectoral distribution of credit etc. generally feed into decisions on the monetary policy stance.

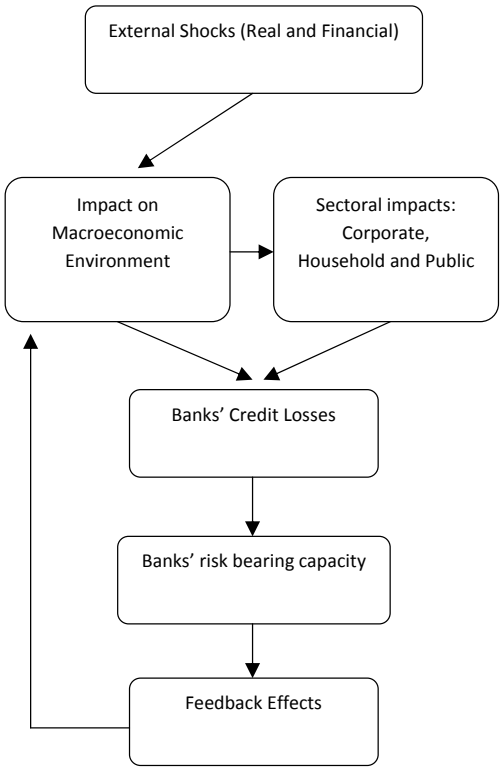
[30] Recent market decline, specifically since April 18, FY08, is again seen as an outlier.

Special Section: Framework for Macro Stress Testing[31]

A financial stability framework helps to detect vulnerabilities in the financial system by relying on a variety of indicators and quantitative techniques. Macro stress testing, one such quantitative technique widely used by central banks around the world for assessing potential risks to financial stability, encompasses a range of quantitative tools to assess the impact of 'exceptional but plausible' macroeconomic conditions on the risk framework of a financial institution or a group of financial institutions.

Stress testing techniques for the financial sector are generally designed in the context of specific types of risks (credit risk, market risk, operational risk etc.). The key building blocks and channels of transmission of a typical macro stress testing exercise for credit risk are displayed in **Figure 1**.[32] The first step in this process is the identification of relevant shocks emanating from both the domestic and international operating environment, which could potentially cause severe problems for the domestic financial sector. For instance, the recent hike in oil prices, the steep rise in housing prices in the recent past, mounting current account and fiscal deficits, indirect impact of the ongoing financial market turmoil etc. can all translate into potential shocks for the financial system.

Figure 1: Framework for Macro Stress Testing



A range of models can be used to translate specific shocks into consistent macro scenarios. This process involves the identification of the transmission mechanism and estimation of various links by using relevant data. This exercise provides the future expected path of macro variables (like GDP, inflation, interest rates, exchange rate, unemployment rate, asset prices etc.) in response to the shocks identified in the first step.

Estimation of credit risk models can help assess the impact of changes in the macroeconomic environment that will impact sector indicators. Sectoral probabilities of default or sectoral bankruptcies are linked to macro variables to calculate banks' credit losses. Alternatively, banks' credit quality indicators (loan loss provisions, non-performing loans etc.) directly linked to macro variables, facilitate the calculation of banks' credit losses, which can then be mapped to their risk-bearing capacity. Finally, there may also be feedback effects if these banks need recapitalization or have implications for the overall macroeconomic environment and/or financial stability.

[31] This section has benefited from comments by Dr. Burkhard Drees (Course Instructor at the SEACEN-FSI-IMF Regional Seminar on Economic Policies for Financial Stability) from the IMF Training Institute.

[32] This general framework for macro stress testing is adapted from Martin (2007), Valentinyi-Endresz and Vasary (2008), and Haldane et.al (2007).

A credit risk model of the banking system that links banks' credit quality indicators to macroeconomic variables, is one of the key steps in macro stress testing.[33] The model is also used for generating a portfolio loss distribution, in addition to the calculation of expected and unexpected losses under the base-line and stress scenarios.

Credit Risk Model

A credit risk model generally takes into account all the policies, procedures and practices of a financial institution in estimating the probability density function (PDF) of its credit losses. The PDF not only reflects the riskiness of the underlying credit portfolio, it also facilitates the calculation of expected and unexpected credit losses over the preferred time horizon. Expected credit loss (or credit risk) at any point in time is the sum of expected losses due to default by individuals or companies for all credit facilities. Mathematically, it can be written as follows:

$$EL_t = \sum_{i=1}^{n} E_{i,t} * PD_{i,t} * LGD_{i,t}$$

Where EL_t denotes expected losses of the underlying portfolio; $E_{i,t}$ is the exposure to an individual or company *i* at time *t*; $PD_{i,t}$ is the probability of default of the individual or company *i* at time *t*; and $LGD_{i,t}$ is the expected loss given default. The final results from this model are critically dependent on the modeling assumptions and the choice of functional specifications for all three components.

Literature on credit risk modeling indicates that it primarily focuses on the relationship between macroeconomic variables and the probability of default (PD). In the absence of data on PD, the frequency of occurrence of bankruptcies or credit quality indicators are used for the purpose of empirical investigation, whereas empirical work on Loss Given Default (LGD) is largely constrained due to data limitations.

Methodology

As mentioned above, the non-availability of data on default rates and bankruptcies leads to the use of asset quality indicators in the empirical model. The methodology is based on the approach used by Blaschke et al (2001) for non-performing loans (NPLs), which uses the assumption that NPLs are impacted by developments in the macroeconomic environment. A general specification of this approach can be described mathematically as follows:

$$NPLTLR_t = f(macro\ variables) + \varepsilon_t$$

Where NPLTLR is the NPLs to gross loans ratio; *f* denotes the functional form and ε_t is assumed to be the normally distributed random error term. This general specification can take any functional form and include a number of macroeconomic variables depending on the availability of data. The final linear specification used for this exercise is as follows.

$$NPLTLR_t = \beta_0 + \beta_1 * RIR_t + \beta_2 * Erate_t + \beta_3 * GDP_t + \beta_4 * NPLTLR_{t-1} + \varepsilon_t$$

Where RIR is the weighted average real lending rate, Erate is the average exchange rate, and GDP is the growth rate of the gross domestic product.

The second step is to model dynamics of macro variables. Ideally, the time path of macro variables should be determined by macro-econometric models for the economy. Any other type of model can also be used for this purpose. An ARMA (Auto Regressive and Moving Average)

[33] Detailed review of literature on credit risk models and technical details of this model will be published in a forthcoming Financial Stability Paper by State Bank of Pakistan.

structure is used for all three macro variables.[34] In the next step, the correlation structure of the model (variance-covariance matrix of error terms) is constructed by using vectors of innovations from all regressions. Finally, the future values of macro variables and random innovations based on the correlation structure of the model are used in the simulation of NPL ratios and portfolio losses.[35]

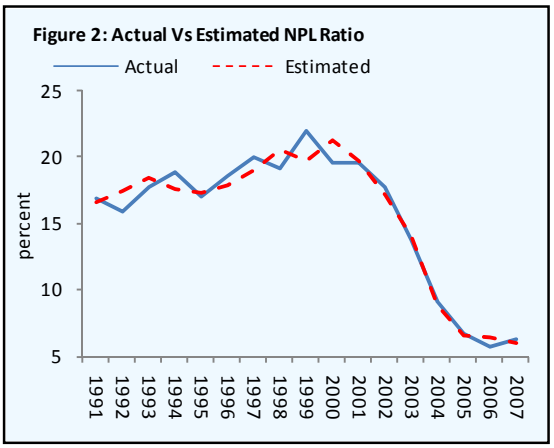
Data and Estimation

This exercise uses the annual time series data ranging from CY73 to CY07. However, the sample varies for basic NPL ratios[36] and macro variable regressions in line with the availability of data. Specifically, the NPLs regression is estimated by using data from CY90 to CY07[37] and the ARMA structure for macro variables is estimated by using annual observations from CY73 to CY07. The estimation searches for the best regression for NPLs ratio and the ARMA structure of macro variables. Regression results for the NPLs ratio indicate that all macro variables are statistically significant, have expected signs and the regression has strong explanatory powers (**Table 1**).

Table 1: Regression Results
Dependent Variable: NPLs to Loans Ratio

	Coefficients	t-Statistics
Constant	12.179	4.689
Real Interest Rate$_t$	0.354	2.184
Exchange Rate$_{t-1}$	-0.122	-4.175
GDP Growth Rate$_t$	-0.570	-1.967
NPLs to Loan Ratio$_{t-1}$	0.615	6.361
Adjusted R-Square	0.947	
No of Observations	18	

High value of the adjusted R-square suggests that over 90.0 percent variation in the NPLs ratio over the period of estimation is accounted for by the explanatory variables. This is also visible in **Figure 2** which depicts the actual and estimated NPLs ratios. Regression results indicate that a 100 bps increase in real interest rates is associated with a 35 bps rise in the NPLs ratio. Similarly, depreciation of the nominal exchange rate and increase in GDP growth rate are likely to reduce the NPLs ratio of the commercial banks. While the negative association between GDP growth and the NPLs ratio is straight forward, the impact of exchange rate depreciation is expected to strengthen the repayment capacity of a special type of borrowers i.e. exporters. Given the major share of the textile sector in banks' total loan portfolio and overall exports of the country, this result is understandable.



In the next step, above NPL regression along with ARMA specifications of macro variables, are used for simulating the value of the NPLs ratio one period ahead, i.e. for the year CY08. By using Monte Carlo simulations, 20,000 simulated values of the NPLs ratio are generated as a base case scenario.[38] In this simulation exercise, it is implicitly assumed that all macro variables will follow their path according to the ARMA structure based on historical data. The distribution of the NPLs

[34] In a simple ARMA model, the dynamics of the variable are explained by its past correlation patterns.
[35] Simulated portfolio losses will represent the base case scenario for the macro stress testing exercise.
[36] NPLs ratio is the NPLs to gross loans ratio of commercial banks.
[37] NPLs data is only available from 1990.
[38] For simulations, first the one-step ahead forecast of macro variables is calculated by using the ARMA structure. A residual is added to each forecasted value by using the information on residual correlation structures of all equations and random numbers from a standard normal distribution. These simulated values of macro variables are used to calculate the simulated values of NPLs ratio. These steps are repeated 20,000 times to generate a distribution for the NPLs ratio.

ratio is approximately normal (**Figure 3**). The descriptive statistics also highlight a normal distribution, given that the measure of: (1) Skewness is negative 0.023; and (2) Kurtosis is 3.01; and probability of the Jarque-Bera test under the null of normal distribution is 0.387. The right tail of the distribution reaches the NPLs ratio of 12.7 percent, which is almost twice the ratio for CY07 but only 57.7 percent of the maximum value of the ratio seen in the second half of the 1990s.

The simulated distribution of the NPLs ratio is also used to calculate the portfolio loan losses of the banking sector. Portfolio losses are calculated as the difference between the NPLs ratios. This calculation makes use of some implicit and explicit assumptions. Specifically, it is assumed that the banking sector extends no new loans over the next one year time horizon. This assumption provides negative loan losses when the simulated NPLs ratio is less than its value for CY07 (i.e. 6.3 percent). Implicitly, reduction in the NPLs ratio implies that some of the NPLs became earning assets over the year. Moreover, the loss calculation also implies that new provisions will be equal to the value of loans that have become non-performing during the year. This assumption is benign in the sense that banks in Pakistan are not allowed to take into account the benefit of the forced sale value (FSV) of collateral in calculating provisioning requirements.[39]

Figure 3: Simulated NPL Ratio

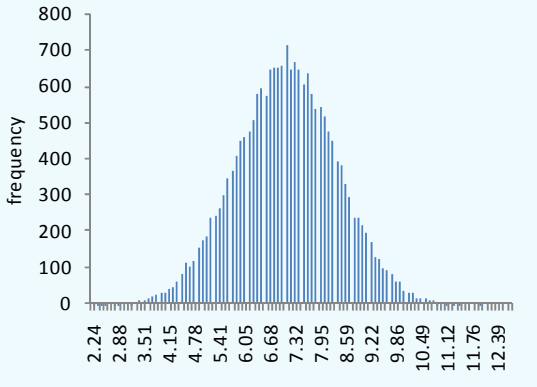
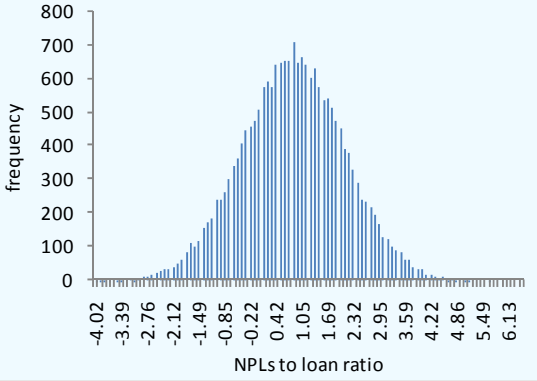


Figure 4: Simulated Portfolio Loss Distribution



Based on all these assumptions, **Figure 4** depicts the distribution of portfolio loan losses for the base case scenario. Interestingly, the loss distribution is also approximately normal with slightly fat tails. Such distributions are generally considered riskier due to the higher probability of occurrence of extreme events. The expected and unexpected portfolio losses for this distribution for the one year horizon are reported in **Table 2**. Specifically, losses at 99.9th percentile are 4.69 percent of gross loans. In other words, the simulations show that there is a one in 1000 times probability that the portfolio losses may be higher than 4.69 percent of gross loans in CY08.

Table 2: Losses in percent of Gross Loans

Expected Loss	0.78
Unexpected Loss at	
95.0%	2.87
99.0%	3.69
99.9%	4.69

Finally, the impact of expected losses on the risk bearing capacity of the banking system is calculated by using banks' loan exposure, risk-based capital and risk-weighted assets. The amount of expected losses is calculated by using banks' exposure as of end-CY07. Both risk-based capital and assets of the banking sector are adjusted for these expected losses, and the

[39] BSD Circular No. 7, October 12, 2007.

revised capital to risk-weighted asset ratio is calculated subsequently. In this process, the loss amount is directly charged to the risk-based capital of the banking sector, as 100.0 percent provisioning is required under the prudential regulations. The loss amount is also adjusted from the risk-based assets, which implicitly assume a write-off of the losses. The difference between the revised CAR and actual CAR as of CY07 represents the impact of expected losses on the CAR of the banking sector. The adjusted CAR of 13.21 percent, with a reduction of 55 bps due to expected losses, is significantly higher than the 8.0 percent minimum requirement for banks.[40]

Stress Testing: GDP Shock[41]

The ultimate objective of performing Monte Carlo simulations in this exercise is to undertake stress testing of the banking sector. A key step in this process is the choice of the stress testing scenario. While there are a number of approaches for defining stress scenarios, the categories of stress scenarios can range from a single factor sensitivity analysis to multivariate macroeconomic scenarios generally based on macroeconomic econometric models of the economy. This is done by using the historical worst case scenario for GDP growth (i.e. a decline in GDP growth by 2.0 percentage points as observed in CY93).

This first requires the identification of extreme negative values of residuals from the GDP regression. This value is standardized by using information on residual variance. The resulting value is replaced with random variables in the vector of standard normal random variables. This step is followed by 20,000 Monte Carlo simulations for the NPLs ratio. The resulting NPLs ratio distribution is used for the comparison of results from the stress scenario with the base case scenario. **Figure 5** shows a clear shift in the distribution's mean from 7.0 to 7.9 percent. The gap between these two ratios represents the impact of the historical negative shock referred to above. The simulated NPLs ratio under the stress scenario is also used for portfolio loss calculations under the assumptions explained in the previous sections. The expected portfolio losses are likely to reach 1.63 percent of gross loans (**Table 3**), which is 85 bps higher than the expected losses under the baseline scenario. A visible rise in unexpected losses under stress is also visible from the Table.

Figure 5: Simulated NPL Ratio

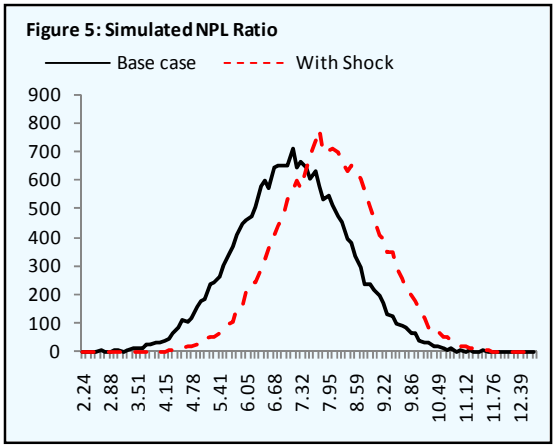


Table 3: Portfolio Losses in percent Gross Loans

	Base line	Under Stress
Expected Loss	0.78	1.63
Unexpected Loss at		
95.0%	2.87	3.56
99.0%	3.69	4.34
99.9%	4.69	5.23

Calibration of these losses to the risk bearing capacity of the banking sector indicates that CAR is expected to undergo a reduction of 116 bps in case of occurrence of the stress scenario. Adjusted CAR at 12.6 percent (more than 1.5 times of minimum requirements) reflects the resilience of the banking sector towards the worst GDP shock.

[40] Increased to 9.0 percent w.e.f 31.12.2008, vide BSD Circular No. 30, dated November 25, 2008.
[41] It may be noted that the idea is not to carry out stress testing in detail, but to explain the process of conducting stress testing in this type of analysis.

Conclusion and Way Forward

This section initiates work on Macro Stress testing as a contribution to the medium to long term development of this framework. In doing so, it briefly explains one of the most widely used macro stress testing technique as applied to the banking system of Pakistan, using annual time series data to estimate links between the NPLs to loan ratio with macroeconomic variables. The dynamics of macro variables are modeled by using the ARMA structure. The best fit regression predicts past developments in the NPLs ratio quite effectively. Additionally, specifications for macro variables are used to simulate the NPLs to loan ratio for the base case scenario. The resulting series is used for calculating the portfolio loss distribution under the assumption of no new loans over a one year horizon. Both expected and unexpected losses for the base case scenario are estimated. The expected portfolio loss in the base case scenario is 0.78 percent of gross loans. The process of stress testing in this environment is also explained by analyzing implications of the historical worst-case scenario for GDP on the loss distribution of the banking sector. The results indicate strong resilience of the banking sector towards this shock.

A Macro-Stress testing framework such as this one can be used to gauge the stability of the banking sector on an annual basis. Since this is the first exercise of its kind, there is a need for continuous refinement of this process, as detailed below.

- ***Refining the Dependent Variables***: In this exercise, the NPLs ratio is used as the dependent variable, while in literature other indicators like provisions against loans are also used. Moreover, a number of studies use logistics transformation of the dependent variables. Further work on this framework will strive to improve the definition of the dependent variables.

- ***Macro variables***: Dynamics of macro variables are modeled by using the ARMA structure. Ideally, the future time path of macro variables should be determined by using macro-economic variables. In the absence of a macro model, efforts can be made to further improve the specification of the macro variables. One possible option could be the use of the VAR model for macro variables.

- ***Scenario Building***: This exercise uses the historical worst case scenario for stress testing. Other approaches like defining scenario-based dispersion of variables may be used in future work. Selection of scenarios is a continuous task, as it will change according to developments in the domestic and international economic and financial environments.

- ***Transmission Mechanism***: In order to initiate work on modeling the transmission mechanism, an understanding of the mechanism though which the impact of a macroeconomic shock is transmitted to the banking sector, is needed. This identification will lead to the estimation of possible links.

- ***Data Frequency***: This exercise is based on annual data. The next step is to replicate it by using quarterly data. The Banking Surveillance Department (BSD) has already estimated a model linking NPLs to macro variables by using quarterly data. There is a need to refine this regression analysis as it manages to explain the variation in quarterly NPLs to the extent of 60.0 percent. Furthermore, while one of the macro variables is statistically insignificant, another appears with the wrong sign.

- ***Feedback Effect***: Lastly, future work will also focus on incorporating feedback effects. This is a really challenging area for research as banks' response to shock is usually difficult to model.

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