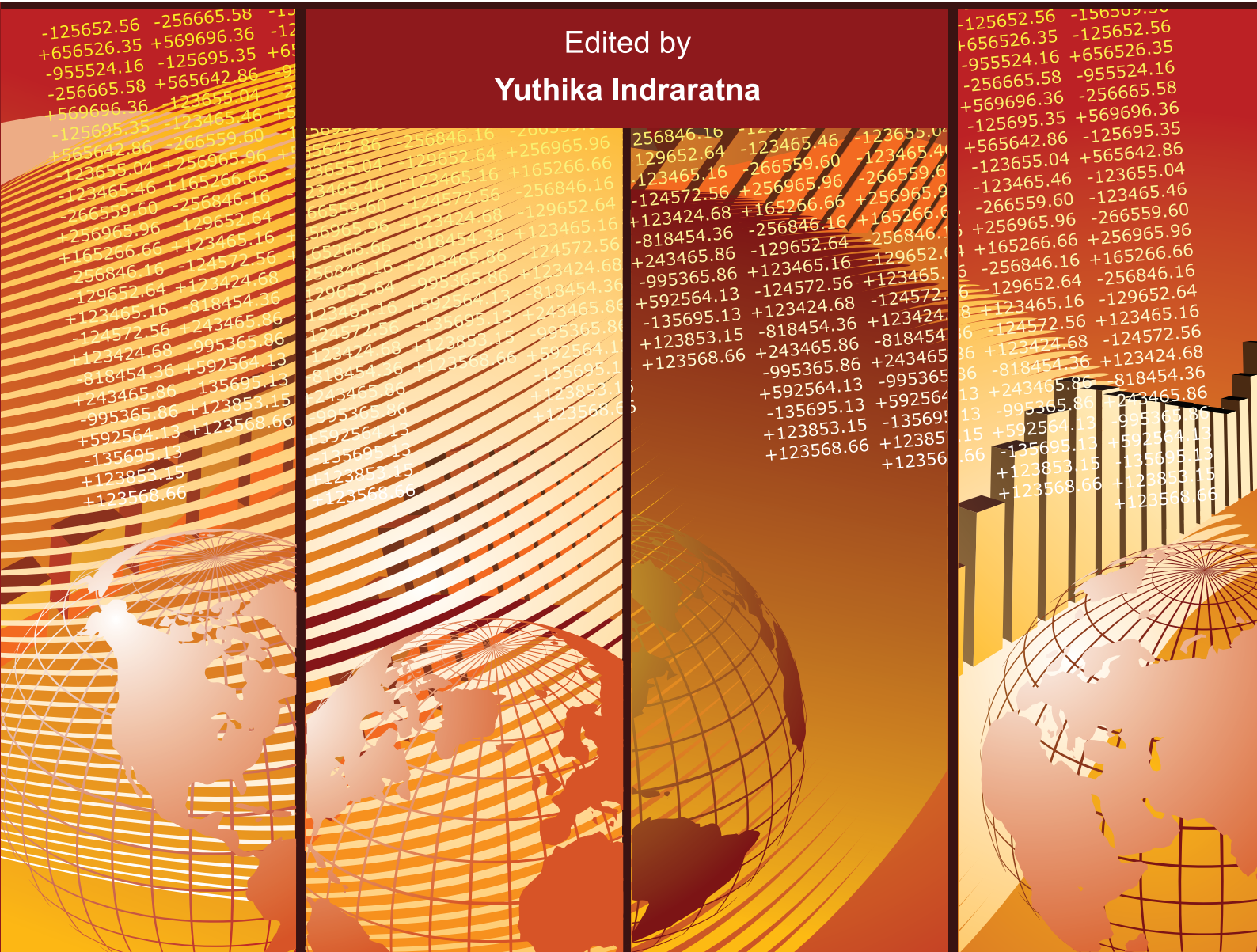# STRENGTHENING FINANCIAL STABILITY INDICATORS IN THE MIDST OF RAPID FINANCIAL INNOVATION

Updates and Assessments

Edited by

Yuthika Indraratna

The **SEACEN** Centre

STRENGTHENING FINANCIAL STABILITY INDICATORS IN THE MIDST OF RAPID FINANCIAL INNOVATION: UPDATES AND ASSESSMENTS

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FOREWORD

In response to the global financial crises in the 1980s and 1990s, national and international institutions started to monitor the soundness of the financial system more intensively. A wide range of instruments/indicators is used to assess financial system stability in analytical practice. These include in particular, analysis of quantitative indicators of financial system soundness and stability, including stress testing. These indicators strive to cover the issue of financial stability as a systemic phenomenon and therefore concern, not only financial institutions and markets, but also the real and government sectors as the main debtors of financial institutions, as well as the financial infrastructure. The inclusion of non-banking sector indicators in the financial stability indicators (FSIs) reflects the interconnectivity of the financial and real sectors, such as for example, unfavourable developments in the corporate sector pass-through to the loan portfolio of banks, thus having possibly a negative effect on financial stability.

Unlike price stability, financial stability has neither a fully established definition nor an aggregate indicator that the central bank can use as a measure of financial instability. Whereas at least some consensus has been reached on the definition of financial stability, the construction of an aggregate financial stability indicator continues to be in the research and experimental phase. The swift pace of financial innovation that has taken place over the course of the last decade further heightened the challenge to establish a comprehensive set of financial stability indicators. The rapid financial innovation has brought about a proliferation of new and increasingly sophisticated financial products and has led to the appearance of new types of institutions as well as created new and expanded roles for existing institutions.

The objective of this study is to assess and review the array of financial stability indicators employed by the SEACEN member central banks as well as the strength and the shortcomings of the available tools, especially in the context of the recent global financial crisis. It also assessed the comparability and consistency of the FSI indicators across the SEACEN economies as well as globally since the objective of a set of financial stability indicators is to provide users with a general idea of the soundness of the financial sector as a whole. Lastly, the study also examined the recent efforts undertaken to further enhance these indicators both globally and also at the SEACEN member central banks, especially in the wake of the recent global financial crisis.

This collaborative research was led by the Project Leader, Dr. Yuthika Indraratna, Additional Director, Economic Research Department, Central Bank

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EXECUTIVE SUMMARY

Introduction

Recent financial crises have brought into focus the importance of financial stability indicators and the need for effective monitoring of these indicators to assess the strengths and vulnerabilities of financial systems. The deregulation of the financial system has encouraged firms to be more profit seeking and innovative increasing their risk taking activities and making the financial system more prone to volatility and failure. In the meantime, the success with which central banks have combated inflation has freed resources to transact in other forms of risk. These developments have brought about an explosive growth in the volume of financial transactions with increasingly complex new instruments that have challenged risk management. The rapid expansion of innovative financial instruments has posed new challenges to central banks as these instruments have increased the risk posed to financial stability. Moreover, the financial mishaps at several high profile institutions generating systemic risk to the financial system have also brought financial stability to the forefront of the attention of policy makers. Occurrences of financial instability have generated sizable negative externalities necessitating the recourse to public funds as a means of overcoming the crises. Banking crises in industrialized economies have resulted in severe disruptions to economic activity. The petering of the financial crisis to the real economy has in turn highlighted the close linkages between financial stability and the health of the real economy. The health of the financial system, therefore, has become a major public policy concern with central banks paying increased attention to monitoring the financial system by focusing on financial stability as a core objective of central banking activities. The focus on financial stability has resulted in improvements to the measurement of financial risk in the recent past with the development of improved methodologies and indicators to measure financial risk. Central Banks have paid increased attention to the role of macroprudential indicators in monitoring the health of the financial system. In the light of these developments, this paper gives an update and assessment of financial stability indicators used by SEACEN economies. The SEACEN economies that participated in the research project comprised Cambodia, Korea, Nepal, Sri Lanka, Indonesia and Chinese Taipei

Measurement of Financial Stability

Financial stability does not have a readily acceptable single indicator for the measurement of financial stability. The toolkit for financial stability measurement can be traced to the theories associated with financial instability episodes with the data requirements pinpointing to the cause of each episode. Theories of debt and financial fragility which identify crises as being due to excesses of borrowing point to rising corporate and household debt as indicators of financial system vulnerability. The monetarist approach to instability emphasizes the growth of monetary aggregates as an indicator to be monitored. The liquidity insurance approach pinpoints to microprudential indicators such as capital adequacy and asset quality that assess the condition of a financial institution as indicators to be monitored. Similarly, financial instability theories that revolve around information asymmetries point to the need to monitor microprudential indicators that assess the soundness of financial institutions. Composite indicators of financial stability have also been developed to incorporate interactions between key sectors of the financial system such as the banking sector, the foreign exchange market and the equity market. Financial stability reports, which have become a tool for monitoring financial stability in the recent past, have adopted a macroprudential policy toolkit to identify and analyse key systemic risks to the financial system. Thus, tools used for measurement of financial risk include microprudential indicators, macroeconomic variables and market indicators. Financial Soundness Indicators (FSIs) of the IMF are widely used macroprudential indicators that assess the health and stability of financial systems. FSIs monitor the health of financial institutions and markets, and the health of the corporate and household sectors while including macroeconomic indicators that support the assessment of strengths and vulnerabilities of financial systems. In addition to macroeconomic variables, FSIs therefore include both aggregated microprudential indicators that assess financial institutions and the markets in which they operate, and indicators that assess the vulnerability of the corporate and household sectors. However, with the advent of the financial crisis in 2007, the analytical framework for the measurement of financial risk has undergone substantial changes with the development of a new perspective on macroprudential policy. In the recent past, increased attention has been paid to risk measurement at the macro level with the focus of risk shifting from the individual firm to the whole financial system. This has meant that a shift in the analysis of risk measurement involves addressing risks arising from procyclicality of the business cycle and the interconnectedness between financial institutions. A key question that can be raised in this regard is how the risk measures relate to macroeconomic developments.

Macro-financial Linkages

Macroeconomic policies have a direct impact on microeconomic institutions such as banks and other financial institutions while the performance of microeconomic structures also have a bearing on the macroeconomy. Real sector growth is ultimately reflected in the profitability of financial institutions and other sectors of the economy. GDP growth can affect financial stability via two main channels - asset prices and the financial performance of borrowers. Undue fluctuations in asset prices can lead to financial instability. Moreover, lower GDP growth will affect the business performance of borrowers placing pressure on their repayment ability which will in turn have adverse implications on bank balance sheets. Similarly, macroeconomic variables such as interest rates and the inflation rate can impact bank balance sheets affecting the health of the financial system. While changes in interest rates affect the maturity transformation of banks' assets and liabilities, high inflation can also be difficult for banks in performing maturity transformation as banks cannot determine the real interest rate. High rates of inflation can also lead to default in repayments of interest and principle which in turn will increase non-performing loans of financial institutions exerting a negative impact on balance sheets. An excessive growth in credit can also impact the stability of the financial system by increasing prudential risks at the micro and macro levels. Excessive credit growth can reduce loan quality, increase systemic risk and worsen bank soundness. Capital inflows can lead to inflation, an appreciation of the exchange rate undermining the competitiveness of the tradable sector or asset price bubbles which can have ramifications on financial stability. The health of financial institutions can in turn affect the ultimate objective of achieving macroeconomic goals. Therefore, an analysis of macroeconomic variables and their linkage to financial institutions is critical to the analysis of financial stability.

New Perspective on Macro Prudential Policy

The recent literature on financial stability has seen a re-orientation of the analytical approach for financial stability with renewed emphasis placed on macroprudential policy in terms of systemic stability. The 2007 financial crisis highlighted the limitations in the analytical approach hitherto used for financial stability triggering a major shift towards an overarching policy framework to address the financial system as a whole – a macroprudential policy framework. The crisis underscored the inadequacy of supervision and regulation restricted to a microprudential policy framework aimed at ensuring the soundness of

individual financial institutions. During the pre-crisis period, prudential regulation was couched with the perspective that "the whole system is sound if each institution is sound". Prudential tools were calibrated with respect to the risk of each individual institution on a stand-alone basis regardless of their relationship with other institutions. The financial stability approach adopted during the pre-crisis period downplayed the role of the macroeconomy in systemic risk where macroeconomic shocks were considered to be exogenous with less attention paid to feedback effects between the financial system and the real economy. The financial crisis of 2007 brought into question the sole reliance placed on price stability and microprudential regulation as a means of achieving macroeconomic stability. The crisis was seen as a bust of a major financial cycle where during the boom period, there existed a build-up of imbalances and overstretched balance sheets through credit expansion and a build-up of asset prices. Imbalances that had built up during the boom period had caused the subsequent bust. The feedback between the financial and the real economy was evident during the boom and bust periods. The crisis resulted in funding and liquidity stresses in the banking system with contagion not shown through payment and settlement systems which were intact. Low and stable inflation was seen as no guarantee for financial and macro stability while a prudential framework based on microprudential regulation was also not sufficient for financial stability. The financial crisis gave a boost to macroprudential regulation and supervision.

The distinction between the micro and macro dimensions of financial stability can be drawn in terms of the *objective* of the task and the *conception* of the mechanisms influencing economic outcomes. The *objective* of macroprudential policy is seen in terms of limiting the costs to the economy from financial distress which can also be referred to as systemic risk. In terms of *conceptions* of the functioning of the economy, the macroprudential dimension can be defined as viewing system outcomes as critically determined by the collective behaviour of individual institutions. In other words, outcomes are endogenously determined within the system wherein feedback effects resulting from the collective actions of the individual institutions are taken into account. Therefore, the term "macroprudential" can be used to denote a system wide analysis conducted for financial stability purposes as distinct from the traditional microprudential analyses examining the stability of individual financial institutions.

The analytical approach to the re-oriented macroprudential policy recognises two dimensions of risk to financial stability - how risk is distributed in the financial system at a given point of time (cross sectional dimension) and how aggregate risk to the financial system develops over time (time dimension). The calibration

of macroprudential tools is based on the way risk is treated in macroprudential analysis. In the cross sectional dimension, risks to the financial system arise due to common exposures across the financial system and interlinkages between financial institutions. The main policy question in this regard is how to limit the risk arising from common exposures and interlinkages on a significant portion of the overall financial system. In order to address this problem, macroprudential policy takes a top-down approach where once a system wide risk measure has been calculated, the contribution of each institution to this risk is taken into account and prudential tools such as capital and liquidity requirements adjusted to reflect the risk of each institution. The time dimension of macroprudential policy deals with how systemic risk develops over time. System wide risk arises from the procyclicality of the financial system i.e., the tendency of the financial system to amplify the ups and downs of the real economy. In this regard, the macroprudential approach stipulates tools that encourage the build-up of buffers in good times so that they can be drawn down when stresses materialise. In recent years, central banks have resorted to a variety of macroprudential tools to promote the resilience of the financial system as a whole. Examples of some macroprudential tools that have been used in the Asian region include Loan-to-value (LTV) ratios, credit ceilings, countercyclical capital buffers, capital surcharges for systemically important banks, limits on currency mismatches and loan-to-deposit requirements.

Structure of the Financial Systems of SEACEN Economies

Traditional measures of financial deepening based on monetary and credit aggregates show a diverse picture for the SEACEN economies under study. These indicators show a cross section of financial systems from advanced to the less developed indicating that the financial systems of the SEACEN economies under review are at different stages of development. An examination of traditional measures of financial deepening such as monetary and credit aggregates show a rapid process of financial deepening for Chinese Taipei and Korea among the SEACEN economies surveyed with these indicators reaching levels comparable to those of western advanced nations. At the other end of the spectrum can be seen economies such as Cambodia whose financial structure is still at a rudimentary stage of development. Moreover, newer indicators of financial deepening such as those relating to financial markets also lend support to the sophisticated nature of the financial systems of these two economies. However, notwithstanding these developments, an examination of assets and deposits of the financial systems pinpoints to the dominance of the banking sector

in the financial structures of these SEACEN economies. While assets held by banking institutions of these economies account for over two thirds of all assets in the financial system (although in Korea this figure amounts to a high of 58 percent), deposits held by banks account for well over 70 percent of all deposits in the financial system. Therefore, although there is a wide disparity in the degree of sophistication in the financial structures of the SEACEN economies under surveillance, banks are still the dominant stakeholder in these financial structures. As banks are key stakeholders in the financial system, the quantitative assessment of financial stability largely concentrates on the soundness of the banking system.

Financial Soundness Indicators in SEACEN Region

Financial stability indicators for the SEACEN region are assessed through a comparison of Financial Soundness Indicators (FSIs) of economies under review, i.e. Cambodia, Korea, Nepal, Sri Lanka, Indonesia and Chinese Taipei. As banks are key stakeholders in the financial systems of these economies, the assessment of financial stability largely concentrates on the soundness of the banking system focusing primarily on the financial condition of the banking sector in terms of profitability, solvency, asset quality and liquidity indicators. Among the SEACEN economies surveyed in the paper, Korea appears to have the most comprehensive coverage of FSIs with 12 core and 15 encouraged indicators compiled and disseminated through the IMF FSI website. The Indonesian FSIs cover the banking sector FSIs disseminated in the IMF website for financial soundness indicators. In the case of Sri Lanka, FSIs are compiled for the banking sector and finance companies separately although both constitute deposit takers. The FSIs reported in the paper relate only to the banking sector. Sri Lankan FSIs are not disseminated in the IMF website at present but published in Financial Stability Reports of the Central Bank of Sri Lanka. The FSIs for Chinese Taipei, which are compiled in accordance to the IMF methodology, include those for deposit takers as well as households and markets. These FSIs are not disseminated through the IMF website but published annually in the Financial Stability Report of Central Bank, Chinese Taipei. The FSIs for Nepal and Cambodia cover the banking sector and are not disseminated through a publication or website.

Core Indicators

Profitability ratios in terms of ROA and ROE indicators for the SEACEN economies under review show positive ratios reflecting the generation of profits out of banking sector assets and equity. ROA and ROE indicators for Korea and Chinese Taipei are akin to those in developed economies being comparatively lower than that of other SEACEN economies. The seemingly lower profitability indicators for Korea and Chinese Taipei may be indicative of a more competitive and less risk averse banking sector in these economies. Profitability indicators also move in tandem to economic conditions with most economies showing improved profitability for the banking sector during the years 2010 and 2011 in particular reflecting better economic conditions in comparison to generally lower ROA indicators seen during the economic downturn experienced in 2008 and 2009. The FSI interest margin to gross income, which measures the relative share of net interest earnings in comparison to gross income, has high numerical values exceeding 50 reflecting the profitability of the banking sectors. However, in the case of Sri Lanka, this FSI has a lower numerical value reflecting implicit taxation in the form unremunerated reserve requirements. The FSI non-interest expenses to gross income for the SEACEN economies under review shows high values except for Sri Lanka which has a lower value reflecting the importance of interest and **non-income interest** for the banking sector in Sri Lanka.

Capital adequacy indicators that measure the extent to which a banking system is able to withstand shocks show that the banking sectors of these economies are well capitalized. The regulatory capital to risk weighted assets FSI shows most economies, with the exception of Nepal for 2008 and 2009, meeting the minimum 8 percent capital adequacy requirement. An analysis of core capital strength for the banking sectors of Korea, Indonesia and Sri Lanka reveal high Tier 1 capital components well above 50 percent in the banking sectors with capital buffers strengthening over time.

As the solvency of a financial institution is mainly affected by the impairment of assets, it is important to examine the quality of assets. Asset based FSIs such as non-performing loans to gross loans remain below 5 percent for most of the SEACEN economies under review. While the higher income economies in the region such as Chinese Taipei and Korea have very low NPL ratios below 1 percent, economies such as Sri Lanka and Nepal carry higher ratios of around 6 percent for the period under study. Meanwhile, Cambodia and Indonesia have NPL ratios below 4 percent in general. With regard to sectoral distribution of

loans, it is noted that enhanced exposure to collateral in the form of gold and property can have adverse repercussions on financial system stability.

Liquidity indicators of the SEACEN economies under review are in accordance to required standards reflecting the importance given to liquidity management in the risk management process. Adequate liquidity buffers have been maintained as shown by the Liquid Asset ratios of the SEACEN economies surveyed. The liquid asset ratios range from about an average of 36 percent for Korea to 12 percent in Chinese Taipei. Similarly, the liquid assets to short term liabilities ratios for the banking sectors of Korea, Chinese Taipei, Indonesia and Cambodia range from 15.7 percent in Chinese Taipei to 109 percent in Korea.

As financial institutions are increasingly diversifying away from their traditional intermediation function towards market making and trading activities, market risk can have a significant impact on the assets and liabilities of financial institutions. In the case of currency risk, the FSI net open position in foreign exchange to capital can be used to examine the exposure to foreign exchange risk. This indicator for the SEACEN economies under review appears to be available for only five economies – Chinese Taipei, Korea, Indonesia, Sri Lanka and Cambodia. All economies except Sri Lanka show positive open positions in terms of this indicator for the period 2009 to 2011.

Encouraged Indicators

Real estate markets can be a source of instability for the financial system. As real estate is subject to severe boom and bust price cycles, the concentration of real estate in the balance sheets of financial institutions warrants close monitoring of real estate indicators. Financial soundness indicators monitoring the real estate sector include real estate price indices and real estate loans to residential and commercial sectors. Amongst the economies surveyed in the SEACEN region, real estate market indicators are available for Korea, Chinese Taipei and Indonesia. While land prices in Chinese Taipei have risen by about 12 percent from 2005 to 2010, in Korea the residential real estate index has risen by about 6.8 percent in 2011. The steep rise in the residential real estate price index warrants close monitoring especially as real estate related residential and commercial loans account for about one-fifth of total loans granted by banking institutions. In the case of Chinese Taipei, macroprudential measures introduced reduced the share of residential real estate loans in 2010 to 29.99 percent from the 30.57 percent witnessed a year earlier. In Indonesia, real estate prices have

increased by an average of about 3 percent from 2008 to 2011 – below the 6 percent average rate of inflation observed for the period. However, the exposure of the banking sector to the real estate market is relatively lower than that of Korea and Chinese Taipei with residential and commercial loans accounting only for about 8 per cent and 6 percent of total loans respectively

High levels of borrowing by the household sector can impair the balance sheets of financial institutions in the event households are unable to make repayments of interest and principle on borrowed funds to financial institutions. FSIs that monitor the household sector constitute the household debt to GDP FSI and the household debt service and principal payments to income FSI. Amongst the SEACEN economies under scrutiny, the household debt to GDP FSI is only available for Korea and Chinese Taipei. The household sector constitutes a very important segment of the economy for both economies with household debt/GDP ratios hovering above 80 percent. The household debt service and principal payments to income FSI, which is only available for Chinese Taipei, reflects the substantial debt service payments incurred by the household sector. Debt service payments show a decelerating trend in the recent past accounting from about half of disposable income in 2005 to about one-third of disposable income in 2011. The macroprudential measures taken by the authorities to stem real estate related loans would have favourably impacted the ratio to reduce to lower levels.

Macro-financial Linkages – Macroprudential Policy Case Studies

The paper also deals with a few macroprudential policy case studies highlighting macro-financial linkages. The case study on Sri Lanka examines the risks posed to the time dimension of financial stability by credit growth. An acceleration in credit growth to as much as 34 percent in 2011 necessitated the authorities to impose a macroprudential tool – a credit ceiling – to reduce the pace of growth in private sector credit. The credit ceiling and the contractionary monetary policy measures adopted reined in credit growth averting possible inflationary pressures and strengthening the stability of the financial system. An examination of the sectoral decomposition of credit and other macro-financial indicators such as share price and land price indices do not show the formation of bubbles in the economy. However, the close monitoring of non-performing loans is essential as default vulnerabilities appear with time. The case study on Chinese Taipei highlights macroprudential policies undertaken to stabilize the housing market. The macroprudential measures taken by the central bank such as loan-to-value ratios on second (or more) housing loans for home purchases,

tightening of underwriting standards for real estate loans have reduced the share of real estate loans of financial institutions. The case study on Cambodia highlights the risks associated with dollarization for financial stability. Dollarisation adds to banking sector vulnerabilities through currency mismatches, exchange rate and credit risks and dollar non-performing loans.

Chapter 1

**STRENGTHENING FINANCIAL STABILITY INDICATORS
IN THE MIDST OF RAPID FINANCIAL INNOVATION:
UPDATES AND ASSESSMENTS
INTEGRATIVE REPORT**

By
Dr. Yuthika Indraratna[1]

Introduction

Financial stability has taken centre stage in the recent past bringing into focus the importance of financial stability indicators and the need for effective monitoring of these indicators to assess the strengths and vulnerabilities of financial systems. Financial crises have unfolded in emerging market economies as well as industrialised countries with severe disruptions to economic activity. Financial crises have propagated into economic crises demonstrating the close linkages between financial stability and the health of the real economy. The globalisation of the world economy has resulted in crises spilling over to other countries with wider repercussions beyond the frontiers of the economy originating the crisis. Occurrences of financial instability have generated sizable negative externalities necessitating the recourse to public funds as a means of overcoming the crisis. The health of the financial system, therefore, has become a major public policy concern with central banks all over paying increased attention to monitoring the financial system by focusing on financial stability as a core objective of central banking activities. The focus on financial stability has resulted in substantial improvements in the measurement of financial risk in the recent past with the development of improved methodologies and indicators to measure financial risk.

In the light of these developments, the objectives of the research project are threefold; (i) to assess and review financial stability indicators in SEACEN economies; (ii) assess the comparability and consistency of FSI indicators in SEACEN economies and (iii) to examine recent efforts undertaken to further enhance indicators both globally and in SEACEN economies.[2] In line with these

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1. The Project Leader, Dr. Yuthika Indraratna, is Additional Director in the Economic Research Department of the Central Bank of Sri Lanka and concurrently Visiting Research Economist at The SEACEN Centre during OY 2011/12.

2. The SEACEN economies that participated in the research project comprised Cambodia, Korea, Nepal, Sri Lanka, Indonesia and Chinese Taipei.

objectives, the paper is organised as follows. Section 1 provides a brief introduction to financial stability. Section 2 introduces the measurement of financial stability taking stock of the indicators available at present while reviewing literature on these indicators. Section 3 gives a detailed analysis of macroprudential indicators for financial stability. A discussion on the linkage between macroeconomic variables and the financial sector is provided in Section 4. Section 5 provides a discussion on the new perspective of macroprudential policy. Section 6 gives a brief description of the financial structures of the SEACEN economies under review. Section 7 provides a review and analysis of financial soundness indicators used in the SEACEN region. Section 8 details a few selected case studies on macro-financial linkages and the use of macroprudential measures. Section 9 concludes.

1. Financial Stability

The definition of financial stability has been an active area of debate in the recent past. Financial stability, unlike price stability, does not have an established definition and is described in terms of positive or negative connotations. Andrew Crockett describes financial stability as requiring stability in both financial institutions and markets (Crockett, 1997). Stability in institutions is achieved when financial institutions can meet their contractual obligations without recourse to outside assistance and there are no stresses in these institutions that can cause immeasurable damage to the economy as a whole.[3] Stable markets operate when participants can confidently transact in these markets at prices that reflect fundamental values which do not vary over short periods when fundamentals do not change. According to Schinasi, "a financial system is in a range of stability whenever it is capable of facilitating (rather than impeding) the performance of an economy, and of dissipating financial imbalances that arise endogenously or as a result of significant adverse and unanticipated events" (Schinasi, 2004). Schinasi's definition takes a positive approach to financial stability where certain conditions necessary for the maintenance of stability are premised under this definition.[4] The Czech National Bank (CNB) defines financial stability with a negative connotation 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"

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3. Occasional failures of financial institutions that impose economic hardship on a limited group of customers or counterparties do not constitute financial instability.

4. Schinasi's definition encompasses financial institutions, markets and the infrastructure with stability relating to the ability of the financial system to contain the emergence of imbalances and disturbances from impacting the real economy adversely.

(Frait and Komarkova, 2011). Although definitions of financial stability are couched in positive or negative terms, there is general consensus that the objective of financial stability is to attain a level of stability in the provision of financial services that will support an economy to achieve maximum economic growth.

Risks in the financial system have increased due to structural and secular factors (Tsatsaronis, 2005). A key structural factor that has led to this focus is the deregulation of the financial system. Deregulation has transformed the global financial structure. Increased competition has encouraged firms to be more profit seeking and innovative. This has also resulted in the growth of the financial system with financial activities growing in size and enhancing their contribution to economic activities. Deregulation has also encouraged risk taking activities making the financial system more prone to volatility and failure. A secular factor that has been cited as being responsible for the focus on financial stability is the success with which central banks have combated inflation which in turn has affected the interaction between the real and financial sector (Tsatsaronis, 2005). Reduced macro uncertainty has freed resources to transact in other sources of risk. Such an environment can lead to the build-up of financial imbalances which in turn can be a source of macroeconomic instability.

2. Measurement of Financial Stability

Unlike price stability, financial stability does not have an established single indicator that can be used as a measure of financial stability.[5] The toolkit for financial stability measurement has emerged from the financial stability theories espoused from time to time with the data requirements pinpointing to the causes of instability associated with each instability episode (Davis, 1999).[6] Theories of debt and financial fragility associated with Fisher (1933), Kindleberger (1978) and Minsky (1977) emphasise the close correlation of financial fragility and macroeconomic cycles as a result of an increase in debt financing in the economy. Crises are identified as being due to previous excesses of borrowing. The theory points to rising corporate and household debt as indicators of financial system vulnerability. The monetarist approach (Friedman and Schwartz, 1963) identifies crises resulting from the inability to pursue steady and predictable monetary policy emphasising the growth of monetary aggregates as an indicator to be monitored. The liquidity insurance approach of Diamond and Dybvig (1983) states that although banks provide liquidity insurance to depositors by pooling risks,

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5. In the case of price stability, change in the price level is readily measured by a price index such as the consumer price index, the wholesale price index, etc.
6. For a detailed analysis of theories of financial instability see E. Philip Davis (2004)

liquidity failures lead to bank runs. This theory pinpoints to the need for microprudential indicators such as capital adequacy and asset quality indicators to assess the condition of a financial institution. Studies that focus on information issues (Mishkin, 1991) pinpoint to financial instability arising from information asymmetries between creditors and borrowers, which can lead to a situation where high quality investment is displaced by low quality investment resulting in a deterioration in the banks' overall portfolio. This theory again pinpoints to indicators that assess the soundness of the financial institution.

Financial Stability Reports published by central banks throughout the world and international agencies pinpoint to a number of quantitative tools developed to assess financial stability. These range from macroprudential indicators developed by the IMF (IMF, 2006) and the ECB (Agresti et al., 2008) to monitoring variables used by Hawkins and Klau (2000), Nelson and Perli (2005) and Gray et al. (2007) which focus on market pressures, external vulnerability and banking system vulnerability. At the micro level, risk measurement has made strides with respect to credit risk, liquidity risk and market risk where advanced methodologies have been developed to measure such risk (Tsatsaronis, 2005). Typical tools include refinements to value-at-risk methodologies, the extension of similar concepts to the analysis of credit risk, as applied to both portfolios of traded securities and non-traded assets, and the development of stress testing (Tsatsaronis, 2005). Stress testing, a technique used by financial institutions to gauge their potential vulnerability to extreme but plausible circumstances, has been practiced widely by many countries especially since the onset of the most recent financial crisis.[7] Out of the SEACEN economies surveyed, stress testing is practiced in Korea, Chinese Taipei, Indonesia and Sri Lanka.[8]

More recently, composite indicators of financial stability have been developed to include interaction between key sectors of the financial system. Composite indicators comprise combinations of individual variables (eg., bank credit related

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7. The most common of these techniques involve the determination of the impact on the portfolio of a firm of a move in a particular market risk factor (a *simple sensitivity test*) or of a simultaneous move in a number of risk factors, reflecting an event which the firm's risk managers believe may occur in the foreseeable future (*scenario analysis*).

   The scenarios are developed either by drawing on a significant market event experienced in the past (*historical scenarios*) or by thinking through the consequences of a plausible market event which has not yet happened (*hypothetical scenarios*) (CGFS,, 2000).

8. For an account of stress testing in the Asian region see Siregar and Lim (2011).

to GDP) that are assigned benchmark or threshold values for the purpose of monitoring key sectors of the economy and which serve as leading indicators of crises (Gadanecz and Jayaram, 2009).[9] These measures utilise early warning indicators methods initially developed to examine currency and balance of payments crises to banking crisis [(Demirguc-Kunt and Detragiache, 1997), ((Demirguc-Kunt and Detragiache, 1998), (Kaminsky et al., 1998), (Kaminsky and Reinhardt, 1999), (Borio and Drehman, 2009)]. Composite indicators typically incorporate the banking system, foreign exchange market and asset prices such as equity and real estate in its coverage of risks affecting the financial system.[10] Each composite indicator must take into account the structure of the financial system so that the variables to be included in the composite indicator and the weights assigned may differ from country to country. However, the use of composite indicators is not widespread in Financial Stability Reports published by central banks which extensively focus on sector specific indicators and macro economic variables to assess stability (Gadanecz and Jayaram, 2009). In the SEACEN economies under review, composite indicators in the form of the banking soundness index, the financial stress index, financial stability index and financial stability maps are used by the authorities to gauge financial stability.

Financial Stability Reports (FSRs) have also become a tool for monitoring financial stability and hence a device for a macroprudential policy toolkit (Cihak et al., 2012). As part of its macroprudential policy toolkit, FSRs identify and analyse risks and key systemic risks to the financial system, while engaging in a forward looking discussion of macroprudential policies. In the coverage of systemic risk, FSRs generally concentrate on key systemic risks in bank and non-bank institutions. The analysis of risks can be based on trends in financial indicators and ratios and discussions on sensitivity or scenario stress testing. For the SEACEN economies under scrutiny, FSRs form a part of the macroprudential toolkit for Sri Lanka, Indonesia, Korea and Chinese Taipei. The Korean FSR seems the most advanced in terms of assessing financial stability. The Korean FSR aims to identify and analyse systemic risk while suggesting measures for mitigating risks based on this analysis. Moreover, the Korean FSR provides in-depth analysis of financial market behaviour linking macroeconomic developments to systemic risk. However, there is no analysis of interconnectedness (i.e. linkages or exposures) among domestic banks in any FSR while analyses of systemically important financial institutions are also lacking.

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9. For a comprehensive review of financial stability indicators see Gadanecz and Jayaram (2009).

10. For a detailed description of the construction of a composite indicator see Illing and Liu (2003) and Van den End (2006).

The analytical framework for the measurement of financial risk has undergone substantial changes in the recent past with the development of a new perspective on macroprudential policy. Early usage of the term "macroprudential" referred to a system-wide analysis undertaken for financial stability purposes as opposed to the traditional micro-prudential analysis conducted by supervisory authorities to assess the stability of individual financial institutions. Thus, tools used for measurement of financial risk included microprudential indicators, macroeconomic variables and market indicators. However, although the early approach to macroprudential risk assessment represented a system wide analysis which incorporated macro and market variables to microprudential regulation, individual institutions were assessed on a "stand-alone" basis where, interactions between these institutions and the feedback effects from the macroeconomy to the financial sector, were not emphasised. In the wake of the 2007 financial crisis, increased attention has been paid to risk measurement at the macro level where the focus of risk shifts from that incurred by an individual firm to those faced by the system. This has meant that a shift in the analysis of risk measurement has taken place from the individual firm to the system as a whole where risk measurement involves addressing risks arising from procyclicality of the business cycle and the interconnectedness between financial institutions. A key question that can be raised in this regard is how the risk measures relate to macroeconomic developments.

3. Macro Prudential Indicators

Macroprudential Indicators assess the health and stability of financial systems. These include Financial Soundness Indicators (FSIs) that monitor the health of financial institutions and markets, indicators that monitor the health of the corporate and household counterparts and macroeconomic indicators that support the assessment of strengths and vulnerabilities of financial systems (Sundarajan et al., 2002). FSIs, therefore, include both aggregated microprudential indicators that assess financial institutions and the markets in which these financial institutions operate, and indicators that assess the vulnerability of the corporate and household sectors. A graphical depiction of the framework for macroprudential analysis is shown in Chart 1.

Chart 1
Framework for Macroprudential Analysis
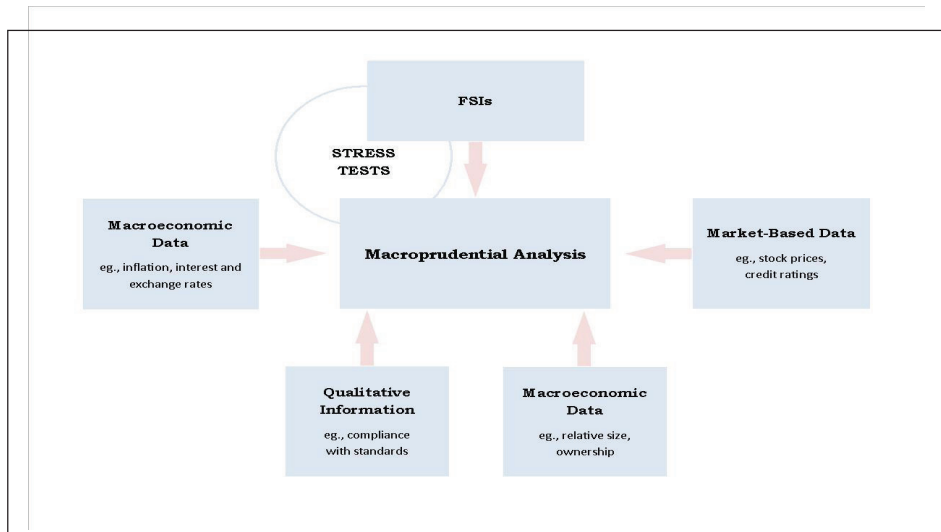
Source: Sundarajan et al. (2002).

Aggregated micro prudential indicators examine the current health of the financial system and are derived by aggregating indicators of the health of individual financial institutions (Evans et al., 2000). These indicators are primarily lagging or contemporaneous indicators of soundness with little predictive power. A framework that is commonly used to assess the health of individual financial institutions is the CAMELS framework which utilises six groups of indicators that reflect the health of financial institutions; Capital Adequacy, Asset Quality, Management Soundness, Earnings, Liquidity and Sensitivity to Market Risk.[11] Capital adequacy indicators are examined as the availability of capital ultimately determines the ability of a financial institution to withstand shocks to its balance sheet. As the solvency of a financial institution is mainly affected by the impairment of assets, it is also important to examine the quality of assets. Indicators of earnings and profitability are also important to keep track of as unprofitable performance can adversely impact solvency of an institution. Liquidity indicators track the ability of an institution to cater to short term liquidity requirements, the poor management of which can lead to insolvency. Sensitivity to market risk indicators can signal the risk arising from changes in interest

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11. For a more detailed discussion of FSIs and the CAMELS methodology see Evans et al. (2000), Sundarajan et al. (2002) and IMF and WB (2005).

rates and exchange rates for investments which can significantly impact the balance sheets of these institutions. Management soundness in the CAMELS framework is generally a qualitative measure applicable to individual institutions and for which there is no indicator that can be aggregated across the sector. Apart from the CAMELS framework indicators, financial soundness indicators also comprise market based indicators which utilise prices of financial instruments and credit ratings of financial institutions to assess financial system vulnerability. In addition to the aforementioned indicators, financial stability analysis also resorts to macro variables which can act as "leading indicators" that signal imbalances affecting the financial system. Financial crises occur when both these types of indicators point to vulnerabilities i.e., when financial institutions are weak and face macroeconomic shocks (Evans et al., 2000).[12]

The European Central Bank (ECB) and the IMF (International Monetary Fund) have produced a set of financial stability indicators termed Macro-Prudential Indicators (MPIs) and Financial Soundness Indicators (FSIs) respectively. The ECB with its mandate to act as a central bank for the European region has over the past decade engaged in the development of a framework for assessing financial stability, particularly in the context of increased integration of national financial systems in the European Union and its obligations under Article 105(5) of the Treaty of European Union to contribute to policies relating to the prudential supervision of credit institutions and the stability of the financial system (Agresti et al., 2008). The IMF responded to the global recession of the 1980s and early 1990s and the East Asian crisis of 1997, which were characterised by asset price swings and securities market collapses, by initiating work on financial stability measurement.[13] It was felt that the lack of data and information and inadequate methodologies to assess financial sector soundness contributed to these crises resulting in an inability to detect financial system problems at an early stage (Agresti et al., 2008). Accordingly, in 1998 the IMF indicated the need for macroprudential analysis defining macroprudential analysis as "based on market intelligence and macroeconomic information, and focusing on developments in important asset markets, other financial intermediaries and macroeconomic developments and potential imbalances".[14] This was followed

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12. Apart from these indicators, financial system stability assessment also requires the examination of

   qualitative factors such as the institutional and regulatory framework.

13. The 1997 Asian financial crisis triggered IMF work on macroprudential analysis, Clement (2010).

14. See IMF (1998),.

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up with the development of macroprudential indicators by the IMF to assess financial sector vulnerabilities. These indicators were later renamed '"Financial Soundness Indicators" following a suggestion of the IMF Board.[15] Accordingly, the IMF first published its guide for the compilation of FSIs in 2006.[16] Differences between MPIs and FSIs reflect mainly variations in the conceptual and methodological approaches of the two institutions as well as their objectives. While the ECB MPIs concentrate on the financial sector with a focus on the banking sector and rely on existing accounting and supervisory standards, the IMF FSIs are set in a broad macroeconomic framework covering all sectors of the economy, not just the financial sector.[17] In assessing and reviewing financial stability indicators for the SEACEN region, the paper resorts to the analysis of FSIs.

3.1 Financial Soundness Indicators

The IMF FSIs are macroprudential indicators that assess the soundness of the entire financial sector. As such, the FSI network reflects interlinkages between the four main sectors of the economy; deposit takers which include banks and other deposit taking institutions such as finance companies; other financial corporations; non-financial corporations; and the household sector. Deposit takers are defined as entities that engage in financial intermediation as their primary activity and those institutions that have liabilities that are payable on demand etc. The other financial corporations sector covers financial corporations that do not accept deposits and include entities such as insurance companies, pension funds, mutual funds and financial auxiliaries. The IMF FSIs incorporate indicators for assessing the risk of financial markets such as the money market, the interbank market, the bond market and the equity market. The corporate and the household sectors are included as they are the main counterparties of the financial sector.

In assessing financial stability, the IMF FSI methodology distinguishes between two sets of indicators - core FSIs and encouraged FSIs. The core set covering 12 indicators are exclusively for deposit takers while the encouraged set which consists of 27 indicators covers the other economic sectors as well as markets (Table 1). The distinction between the core set and the encouraged

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15. See IMF (2001) and Clement (2010).

16. Since its first publication in 2006, the IMF compilation guide on FSIs has been revised in 2008.

17. See Agresti et al. (2008) for a detailed analysis of these two approaches.

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set is also to help prioritise data collection as many countries may not have all the required data (Agresti et al., 2008). Accordingly, the encouraged set which consists of indicators for economic sectors other than the banking sector also incorporates additional indicators for deposit takers which can be compiled in accordance to data availability in a country.

In addition to the aggregated microprudential indicators, the IMF coverage of macroprudential analysis also includes indicators of macroeconomic developments or exogenous shocks that can affect the financial system. Some selected macroeconomic indicators that have been identified as being important for financial stability analysis are given in Table 2. A detailed discussion of some macroeconomic indicators and their impact on financial institutions is provided in the next section.

Table 1
Financial Soundness Indicators

Deposit-taking Institutions	Core Set
Deposit takers	
Capital Adequacy	Regulatory capital to risk-weighted assets
	Regulatory tier I capital to risk-weighted assets
	Nonperforming loans net of provisions to capital
Asset Quality	Nonperforming loans to total gross loans
	Sectoral distribution of loans to total loans
Earnings and Profitability	Return on assets
	Return on equity
	Interest margin to gross income
	Noninterest expenses to gross income
Liquidity	Liquid assets to total assets (liquid asset ratio)
	Liquid assets to short-term liabilities
Sensitivity to Market Risk	Net open position in foreign exchange to capital
	Encouraged Set
Deposit takers	Capital to assets
	Large exposures to capital
	Geographical distribution of loans to total loans
	Gross asset position in financial derivatives to capital
	Gross liability position in financial derivatives to capital
	Trading income to total income
	Personnel expenses to noninterest expenses
	Spread between reference lending and deposit rates
	Spread between highest and lowest interbank rate
	Customer deposits to total (noninterbank) loans
	Foreign currency-denominated loans to total loans
	Foreign currency-denominated liabilities to total liabilities
	Net open position in equities to capital
Other financial corporations	Assets to total financial system assets
	Assets to gross domestic product (GDP)
Nonfinancial corporations sector	Total debt to equity
	Return on equity
	Earnings to interest and principal expenses
	Net foreign exchange exposure to equity
	Number of applications for protection from creditors
Households	Household debt to GDP
	Household debt service and principal payments to income
Market liquidity	Average bid-risk spread in the securities market
	Average daily turnover ratio in the securities market
Real estate markets	Real estate prices
	Residential real estate loans to total loans
	Commercial real estate loans to total loans

Source: IMF, 2006.

Table 2
Selected Macroeconomic Indicators

Macroeconomic Variable	Indicator
Economic Growth	Aggregate growth rates
	Sectoral slumps
Balance of Payments	Current Account Deficit
	Foreign exchange reserve adequacy
	External debt (including maturity structure)
	Capital flows
Inflation	Volatility in inflation
Interest and Exchange Rates	Volatility in interest and exchange rates
	Level of domestic real interest rates
	Exchange rate sustainability
	Exchange rate guarantees
Lending and Asset Price Booms	Lending booms
	Asset price booms

Source: Evans et al. (2000).

4. Macro-financial Linkages

Macroeconomic policies have a direct impact on microeconomic institutions such as banks and other financial institutions while the performance of microeconomic structures also have a bearing on the macroeconomy. Real sector growth is ultimately reflected in the profitability of financial institutions and other sectors of the economy. Similarly, interest rates, exchange rates and the inflation rate can impact bank balance sheets affecting the health of the financial system while the health of financial institutions can in turn affect the ultimate objective of achieving macroeconomic goals. Therefore, an analysis of macroeconomic variables and their linkage to financial institutions is critical to the analysis of financial stability.

In looking at the relationship between the real and financial sectors, Tsatsaronis (2005) cites three challenges faced by central banks in monitoring the performance of financial institutions and health of financial institutions and macro stability; the effect of financial conditions on aggregate expenditure and economic development; the effect of macro variables and conditions of financial institutions and other sectors; and the measurement of financial risk at the micro and macro levels. In addition, improved risk management has increased the understanding on interlinkages and vulnerability between the financial sector and the macroeconomy.

4.1 Impact of Financial Conditions on the Economy

The financial condition of firms and households affect consumption and investment in an economy. The demand for funding by firms and households and the supply of funding by financial institutions are the channels through which the linkage between the financial sector and the real economy operates (Tsatsaronis, 2005). The demand for funds by firms and households is dependent on the financial well-being of these two sectors. Highly leveraged firms and households with inadequate levels of income flows can lead to bankruptcies in financial institutions which in turn will result in dampening macro economic conditions. Similarly, the supply of credit by financial institutions is also dependent on the perceived financial strength of economic agents with asymmetry of information between suppliers and demanders of credit increasing the cost of credit granted. Moreover, the profitability of financial institutions and the wellbeing of households in the economy which is also impacted by real sector growth in turn affects macroeconomic performance. A weakening of the balance sheets of financial institutions can also result in a credit freeze which can be a potential source of instability for the macroeconomy, particularly as markets rely on financial institutions for market making and liquidity provision.

Asset prices play a crucial role in linking the economic agents demanding credit and financial institutions supplying credit. Asset prices of both, financial and real, reflect the expectations of economic agents. Moreover, asset prices also determine the extent of credit granted by financial institutions especially as security is a pre-condition for lending by many institutions. Therefore, asset price fluctuations have a direct and important bearing on balance sheets of financial institutions, which in turn can have ramifications on the economy.

4.2 Impact of Real Economy on Financial Sector

Similar to the impact of financial variables on the macroeconomy, the interaction between the financial sector and the macroeconomy can also run from the macroeconomy to financial institutions. The business cycle influences the profits and incomes of economic agents. Financial conditions in the economy evolve largely in synchronisation with the different phases of the business cycle, i.e., they are highly procyclical (Tsatsaronis, 2005). During periods of boom, households and firms enhance their incomes and profits which in turn, are linked to the profitability and strengthened balance sheets of financial intermediaries. Similarly, in a downturn, financial institutions weaken through a deterioration of asset quality associated with higher default rates arising from a deterioration in the credit worthiness of borrowers. Therefore, financial sector indicators such

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as fees, intermediation margin income and asset quality have strong cyclical components where the former two indicators show high values during boom periods while asset quality worsens during economic downturns. Developing a good understanding of the joint dynamics of these processes and their relationship to the business cycle is key to assessing vulnerabilities of financial conditions at any given economic juncture (Tsatsaronis, 2005).

4.2.1 GDP Growth

GDP growth can affect financial stability via two main channels - asset prices and the financial performance of borrowers (Yokoi-Arai, 2002). Undue fluctuations in asset prices can lead to financial instability. Firstly, a decline in asset prices will result in a decrease in the collateral value of borrowers and capital of financial institutions. When asset prices decline, the repayment ability of borrowers comes under pressure. Moreover, an asset price decline will also result in a decline in the equity price of a financial institution exerting pressure on capital adequacy as capital comprises a large share of shareholder's equity. As a bank's equity price declines, capital adequacy regulations, which require capital to be maintained as a certain percentage of its assets, necessitate the raising of capital or a reduction in assets. Secondly, lower GDP growth will affect the business performance of borrowers placing pressure on their repayment ability. Therefore, a downturn in the economy with a resulting decline in the borrower's performance will have adverse implications on bank balance sheets.

4.2.2 Interest Rates

Literature on financial stability points to a strong correlation between a rise in short- term interest rates and systemic banking crises. A bank's balance sheet is exposed to changes in interest rates.[18] A hike in short- term interest rates affects the maturity transformation of banks' assets and liabilities. As bank assets in the form of advances are generally long- term while liabilities in the form of deposits are short-term in nature, the interest paid on deposits can be adjusted quickly while interest charged against borrowing is locked in for a longer period. Therefore, a hike in short-term interest rates will enable banks to pay out more interest although they will be able to profit from increased income from an interest rate hike only in the long-term with the maturity of the loan. The time lag between the interest payment and interest receipts can erode a bank's balance sheet if the transformation takes a long time.

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18. Non-trading interest rate risk is the sensitivity of a bank's capital and income to changes in interest rates.

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4.2.3 Inflation Rate

The inflation rate strongly affects prices and consumer sentiments. High inflation reduces the quality of information provided by interest rates and prices. In a situation of very high inflation, banks have difficulty in performing maturity transformations as they cannot determine the real interest rate (Yokoi-Arai, 2002). High inflation generally leads to high nominal interest rates. When nominal interest rates are very high, banks tend to overcharge customers burdening borrowers through an erosion of their capital base. Similarly, when nominal interest rates are low, the banks' capital base is eroded. Moreover, volatility of inflation makes the accurate assessment of credit and market risk difficult. High inflation also makes difficult investment planning and credit appraisal for the financial institution. On the other hand, a significant reduction in the inflation rate can lead to lower nominal income and cash flows, adversely affecting the liquidity and solvency of financial institutions (Evans et al., 2000). High inflation can also have an adverse impact on households and corporates as borrowers of financial institutions. High rates of inflation can lead to default in repayments of interest and principle which in turn will increase non-performing loans of financial institutions exerting a negative impact on balance sheets.

4.2.4 Credit Growth

Excessive credit growth can destabilize a financial system. Selim Elekdag and Yiqun Wu (2011) identify three reasons for the rapid growth of credit in a country; financial deepening which supports growth; normal cyclical upswings (demand for and availability of credit tends to increase during recoveries); and excessive cyclical fluctuations (credit booms). Episodes of credit booms are typically associated with financial imbalances.[19] Therefore, rapid growth in bank credit to the private sector can have ramifications for financial stability.

Credit booms can arise due to external or internal factors. In the case of external factors, credit booms are largely associated with large capital inflows. According to Elekdag and Wu (2011), almost 60 percent of all emerging economy credit booms were preceded by an episode of large capital inflows. The type of inflow also matters as the authors find that both portfolio and bank flows, inflows which are more volatile with shorter maturities, have resulted in credit busts. The surge in capital inflows is associated with widening current account deficits, buoyant asset prices and strong domestic demand (Elekdag and Wu,

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19. Credit booms generally refer to an above the trend growth in the credit to GDP ratio.

2011). With regard to internal factors, loose macroeconomic policy seems to contribute to the build-up of credit booms. In particular, low domestic policy rates preceding the credit boom period seem to be associated with credit booms ending as credit busts. Lower policy and lending rates reduce the cost of borrowing thereby incentivising excessive borrowing by households and risk taking on the part of financial institutions while boosting asset prices. This in turn can lead to a de-stabilisation of the financial system. Therefore, monetary policy appears to be an important domestic driver of credit growth.

In terms of the business cycle theory, credit moves in a procyclical fashion with credit growth expanding during boom periods and contracting during the downward swing of the business cycle. When there is vigorous growth in the economy, asset prices increase enhancing the creditworthiness of households, which in turn allows them to increase their borrowings from the banking system due to higher collateral values. Credit, in other words, moves procyclically, increasing during periods of boom.

Although credit growth can spur investment and economic activity, an excessive growth in credit can impact the stability of the financial system by increasing prudential risks at the micro and macro levels (Igan and Pinheiro, 2011). At the micro level, prudential risks can emerge when banks rapidly expand their loan portfolios reaching capacity constraints with regard to managing risks involved in such lending (Igan and Pinheiro, 2011) or when banks engage in granting loans to sub-standard customers without adequate screening and risk management (Berger and Udell, 2004). At the macro level, prudential risks emerge when during boom periods, financial institutions which engage in excessive sub-standard lending, interact with each other and the financial system as a whole becomes riskier. Prudential risks at the macro level can also arise due to the exposure of the banking and financial system to certain specific sectors such as the housing sector as a result of excessive lending made to such sectors.[20] Therefore, excessive credit growth can reduce loan quality, increase systemic risk and worsen bank soundness.

The impact of credit booms on bank balance sheets can be examined by looking at the composition of bank assets and liabilities. Borio and Lowe (2004) use the bank credit to total assets ratio to track the asset side composition of the bank balance sheet arguing that this indicator can signal the state of the financial cycle and thereby the vulnerability of the financial system to a shock

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20. The recent global crisis exemplified the exposure of the US financial system to housing prices as a result of excessive lending of mortgage loans to the housing sector.

in the economy. Moreover, the ratio of total credit to money (M2) is also used to look at the state of the financial cycle as it is argued that as credit increases relative to broad money, the composition of liabilities of the banking sector changes from deposits, which form the core liabilities of a banking system, to non-core liabilities in the form of other sources of funding to cater to the increased credit demand (Shin et al, 2011). Shin argues that when the demand for credit is high, household deposits which constitute the most important source of funding for banks, become inadequate resulting in banks securing funding from other sources such as wholesale funding and foreign borrowings. This is particularly important for open emerging economies as the increase in non-core deposit liabilities is very often reflected in enhanced foreign currency denominated liabilities of the banking system. A high quantum of foreign currency liabilities of the banking system exposes the financial system to foreign currency risk which can have adverse implications for financial stability. Therefore, the ratio of non-deposit liabilities to total liabilities constitutes another indicator that can be used to examine the impact of credit growth on bank soundness.

4.2.5 Capital Flows

Capital flows can benefit economies in many ways including the easing of financial constraints for investment projects where there are limited savings, promoting trade and contributing to the development of financial markets. However, the flowing back of capital to Emerging Market Economies (EME) in particular, since the ending of the financial crisis of 2007 has occupied the minds of policymakers, particularly in EMEs. Discussions have centered on the management of inflow surges, recognising the general benefits of capital flows for economic growth (Ostry et al., 2011). The concern about capital surges has arisen due to the perceived transitory nature of such inflows which can reverse back to advanced economies when policy interest rates in advanced economies return to normal. Therefore, these surges arise largely due to interest rate differentials between EMEs and advanced countries.

Capital inflows can bring about macroeconomic concerns and financial stability risks. Capital inflows can lead to inflation, an appreciation of the exchange rate undermining the competitiveness of the tradable sector or asset price bubbles which can have ramifications on financial stability.[21] With regard

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21. In the case of the exchange rate, the concern regarding competitiveness arises if the exchange rate is overvalued or broadly in equilibrium. In the case of an undervalued exchange rate, the appropriate policy response would be to allow an appreciation of the exchange rate in response to the capital inflow.

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to financial stability, excessive capital inflows can lead to generalised credit booms, balance sheet vulnerabilities of banks or non-financial entities (firms and households) and increases in the prices of systemically important assets such as housing (Ostry et al., 2011). Balance sheet vulnerabilities arise due to risky external liability structures of banks that borrow short-term and lend long-term assets, unhedged currency exposure and the credit risk associated with lending in foreign currency to unhedged borrowers. The theoretical literature on capital flows distinguish five types of capital inflows in terms of their riskiness with foreign currency debt seen as most risky and foreign direct investments seen as least risky (Ostry et al., 2010).[22] In the recent global financial crisis, an examination of the foreign liability structure of EMEs suggest that larger stocks of debt liabilities and financial FDI are associated with worse growth slowdowns (Ostry et al., 2010). These components of inflows make the financial system stability more vulnerable as they are linked to credit booms and foreign exchange denominated lending of domestic banks.

Country responses to capital inflows have utilised a combination of macroeconomic policies, prudential regulations and even capital controls. Macroeconomic policy responses include allowing an appreciation of the exchange rate in the event the exchange rate is undervalued, accumulating reserves to counter the appreciation of the currency, engaging in sterilisation operations if inflation is a threat, lowering the interest rate if possible to lessen capital inflows and tighter fiscal policy. Prudential policies can be categorised as 'FX-related" which refer to regulations based on the currency of denomination of the transaction, and other prudential regulations. The former include measures such as limits on banks' open foreign exchange position and limits on investments in foreign exchange assets that discriminate according to currency while the latter include measures such as loan-to-value ratios and limits on domestic credit growth which are intended to reduce the systemic threat to the financial system without discrimination based on currency or residency status. Capital controls limit cross border movement of capital restraining residents from entering into transactions or effecting payment for these transactions with non-residents. Typical measures include taxes on flows from non-residents, unremunerated reserve requirements and limits and bans, all of which may be economy wide or sector specific measures. In addressing inflow problems, it is suggested that macro policies should be primarily used to deal with macro risks arising from capital surges while prudential tools should be utilised to address financial stability concerns

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22. The catagories comprise foreign currency debt, consumer price indexed local currency debt, local currency debt, portfolio equity investment and foreign direct investment. Within each category, short-term instruments are seen as more risky than long-term instruments.

with capital controls being used to control inflows only after the aforementioned policy tools have been exhausted (Ostry et al., 2011).

5. New Perspective on Macro Prudential Policy

The recent literature on financial stability has seen a re-orientation of the analytical approach for financial stability with renewed emphasis placed on macroprudential policy in terms of systemic stability.[23] The 2007 financial crisis highlighted the limitations in the analytical approach hitherto used for financial stability triggering a major shift towards an overarching policy framework to address the financial system as a whole – a macroprudential policy framework. The crisis underscored the inadequacy of supervision and regulation restricted to a microprudential policy framework aimed at ensuring the soundness of individual financial institutions.

The 2007 financial crisis highlighted the limitations of adhering to the two main pillars of policy during the period of great moderation - price stability as an anchor for monetary policy and microprudential regulation and supervision with the focus on individual entities (Borio, 2011).[24] Prudential regulation was couched with the perspective that the "whole system is sound if each institution is sound" (Borio, 2003). This perspective gave rise to the "bottom-up" approach where solvency was derived from an aggregation of solvency standards for individual institutions and not for the system as a whole. Accordingly, prudential tools were calibrated with respect to the risk of each individual institution on a stand-alone basis regardless of their relationship with other institutions. This can be seen in the setting of Basel II capital standards which were the same for all banks irrespective of their importance in the system. Focus of regulation was on solvency rather than liquidity as the latter was thought to be looked after by deposit insurance schemes. Payment and settlement systems were strengthened with financial infrastructure seen as the main channel through which stress can spread from individual institutions to the system as a whole. The financial stability policy approach adopted during the pre-crisis period downplayed the role of the macroeconomy in systemic risk where macroeconomic shocks

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23. The term "macroprudential" came into prominence in 2000 when the General Manager of the BIS, Andrew Crockett, delivered a speech at the International Conference of Banking Supervisors contrasting the microprudential and macroprudential approaches to regulation and supervision (Crockett, 2000).

24. The great moderation refers to a time period when macroeconomic stability in the form of low inflation was achieved together with economic growth through the pursuit of monetary policy for price stability.

were considered to be exogenous with less attention paid to feedback effects between the financial system and the real economy.

The financial crisis of 2007 brought into question the sole reliance placed on price stability and microprudential regulation as a means of achieving macroeconomic stability. The crisis was seen as a bust of a major financial cycle where during the boom period, there existed a build-up of imbalances and overstretched balance sheets through credit expansion and a build-up of asset prices (Borio, 2003). Imbalances that had built up during the boom period had caused the subsequent bust. The feedback between the financial and the real economy was evident during the boom and bust periods. The crisis resulted in funding and liquidity stresses in the banking system with contagion not shown through payment and settlement systems which were intact. Low and stable inflation was seen as no guarantee for financial and macro stability while a prudential framework based on microprudential regulation was also not sufficient for financial stability. The financial crisis gave a boost to macroprudential regulation and supervision.

Andrew Crockett draws a distinction between micro and macro dimensions of financial stability in terms of the *objective* of the task and the *conception* of the mechanisms influencing economic outcomes (Crockett, 2000). The objective of macroprudential policy is seen in terms of limiting the costs to the economy from financial distress which can also be referred to as systemic risk. In contrast, the micro-prudential objective is seen as limiting the likelihood of failure of individual institutions. The microprudential objective aims at protecting depositors. In terms of conceptions of the functioning of the economy, the macroprudential dimension can be defined as viewing system outcomes as critically determined by the collective behaviour of individual institutions (Crockett, 2000). In other words, outcomes are endogenously determined within the system. Contrastingly, the microprudential analysis regards system outcomes as exogenous or given to the individual firm. The latter analysis disregards any feedback effects resulting from the collective actions of the individual institutions. Instability in the microprudential analysis, which can arise in an individual institution due to an external shock, is propagated through contagion. The macroprudential perspective stresses that actions that may be desirable from the perspective of an individual institution may not result in welcomed outcomes for the system as a whole. In contrast, the microprudential perspective emphasises the dictum that "financial stability is ensured as long as each and every institution is sound" (Crockett, 2000). In a similar vein, Borio differentiates macroprudential from microprudential policy in terms of the *objective* and the *model* used (Borio, 2003). According to Caruana, the term "macroprudential" refers to the use and

calibration of prudential tools with the explicit objective of promoting the financial system as a whole, not just the individual institutions within it (Caruana, 2010). The IMF in a recent publication differentiates macroprudential from microprudential policy in terms of its *objective*, *scope of analysis* (the financial system as a whole and its interactions with the real economy), *set of powers and instruments*, and their *governance* (IMF, 2011). In accordance to all definitions, the term "macroprudential" can be used to denote a system wide analysis conducted for financial stability purposes as distinct from the traditional microprudential analyses examining the stability of individual financial institutions. A comparison of macroprudential and microprudential approaches to regulation and supervision is given in Table 3.

Table 3
Comparison of Macro and Microprudential Perspectives

	Macroprudential	Microprudential
Proximate objective	Limit financial systemwide distress	Limit distress of individual institutions
Ultimate objective	Avoid output (GDP) costs	Consumer (investor/depositor) protection
Characterisation of risk	Seen as dependent on collective behavior ("endogenous")	Seen as independent of individual agents' behavior ("exogenous")
Correlations and common exposures across institutions	Important	Irrelevant
Calibration of prudential controls	In terms of systemwide risk; top-down	In terms of risks of individual institutions; bottom-up

Source: Borio (2003).

Given the system wide focus, macroprudential indicators tend to be broad indicators that signify risks facing financial institutions in general, than the health of the individual institution. The approach treats overall risk in the financial system as dependent on the collective behaviour of financial institutions. Macroprudential policy also highlights feedback effects due to the interconnectedness of macro variables such as credit and asset prices and the behaviour of financial institutions. Macroprudential indicators typically include banking system indicators, macroeconomic indicators and financial market indicators.

5.1 Analytical Framework for New Perspective on Macroprudential Policy

The analytical approach to the re-oriented macroprudential policy recognises two dimensions of risk to financial stability - how risk is distributed in the financial system at a given point of time (cross sectional dimension) and how aggregate risk to the financial system develops over time (time dimension). The calibration

of macroprudential tools is based on the way risk is treated in macroprudential analysis (Borio, 2011).

In the cross sectional dimension, risks to the financial system arise due to common exposures across the financial system and interlinkages between financial institutions. Common exposures and interlinkages can result in financial institutions failing together due to the vulnerability of these institutions to common sources of risk. The main policy question in this regard is how to limit the risk arising from common exposures and interlinkages on a significant portion of the overall financial system. In order to address this problem, macroprudential policy takes a top-down approach where once a system wide risk measure has been calculated, the contribution of each institution to this risk is taken into account and prudential tools such as capital and liquidity requirements adjusted to reflect the risk of each institution. This implies tighter standards for institutions whose systemic risk is larger, which contrasts sharply to the microprudential approach where common standards are applied to all institutions.

The time dimension of macroprudential policy deals with how systemic risk develops over time. System wide risk arises from the procyclicality of the financial system i.e., the tendency of the financial system to amplify the ups and downs of the real economy. During expansionary growth periods, declining risk perception, higher risk tolerance, weakening financial constraints, booming asset prices and growing expenditures reinforce one another, potentially leading to an overextension of balance sheets. The reverse process occurs during recessionary periods amplifying financial distress. The main policy question here is how to dampen the procyclicality of the financial system. In this regard, the macroprudential approach stipulates tools that encourage the build-up of buffers in good times so that they can be drawn down when stresses materialise. Such buffers would allow the financial system to absorb shocks better, lowering the cost of financial distress. The need to build up buffers would also restrain risk taking during expansionary cycles dampening the procyclicality of the financial system.

5.2 Asian Experience

In recent years, central banks have resorted to a variety of macroprudential tools to promote the resilience of the financial system as a whole. Siregar and Lim (2011) differentiate macroprudential measures into three categories - price and quantity based measures to limit credit expansion (e.g. reserve requirements and credit ceilings), regulations aimed at maintaining the quality of loans (loan-to-value ratios, debt-to-income rules, limits on currency mismatches etc) and

measures strengthening the resilience of the banking sector to balance sheet shocks in terms of both assets and liabilities (capital adequacy requirements, composition/type of foreign borrowing etc). The Committee on the Global Financial System (CGFS) categorises this further by type of vulnerability in the financial system (CGFS, 2010). Emerging markets in the Asian region have made active use of macroprudential instruments since the 1990s. Examples of some macroprudential tools that have been used in the Asian region are given in Table 4. Experience suggests that pre-emptive prudential measures that seek to moderate credit and asset price booms can complement traditional monetary policy actions (Caruana, 2010).

Table 4
Asian Experience with Macroprudential Tools

Objective	Tools	Examples
Manage aggregate risk over time (i.e. procyclicality)	• Countercyclical capital buffers linked to credit growth • Countercyclical provisioning • Loan-to-value (LTV) ratios • Direct controls on lending to specific sectors	• China • China, India • China, Hong Kong SAR, Korea, Singapore • Korea, Malaysia, the Philippines, Singapore
Manage aggregate risk at every point in time (i.e. systemic oversight	• Capital surcharges for systemically important banks • Liquidity requirements/funding • Limits on currency mismatches • Loan-to-deposit requirements	• China, India, the Philippines, Singapore • India, Korea, the Philippines, Singapore • India, Malaysia, the Philippines • China, Korea

Source: Committee on the Global Financial System (2010).

6. Structure of the Financial Systems of SEACEN Economies

Traditional measures of financial deepening based on monetary and credit aggregates show a diverse picture for the SEACEN economies under study. Monetary and credit aggregates can be considered proxy measures of savings and credit intermediation in an economy with the indicators expected to rise in response to improved price signalling in the financial sector arising from positive real interest rates.[25] While narrow money can be used to gauge the transactions demand for economic activities, broad money aggregates which show the savings in an economy can indicate the extent of financial deepening. Private sector

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25. A key to financial sector development is the reduction of fragmentation in financial markets which can result from 29 The year 2008 is chosen as the starting point for the analysis as this is the earliest year for which a comparison can be made internationally.

credit which reflects credit given to the "productive" sector can also be an indicator for the level of financial intermediation in a country. These indicators show a cross section of financial systems from advanced to the less developed indicating that the financial systems of the SEACEN economies under review are at different stages of development.

Chart 2
Monetary and Credit Aggregates

M1/GDP Ratio (%)
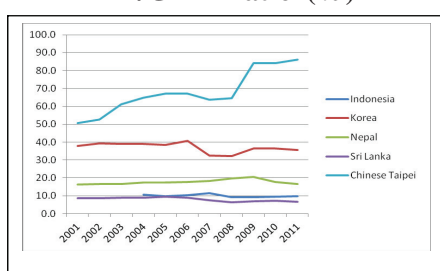
M2/GDP Ratio (%)
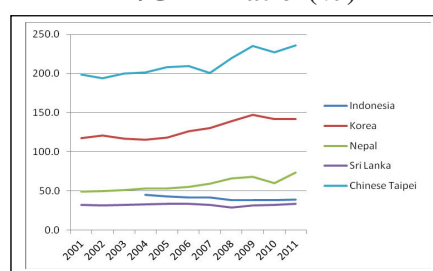
Credit/GDP Ratio (%)
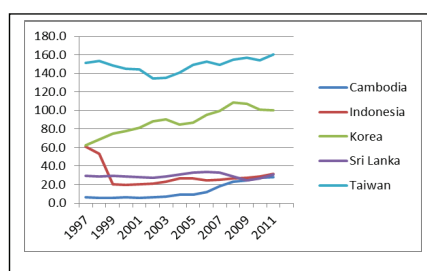
Source: IMF, IBRD, SEACEN Central Banks.

An analysis of the monetary and credit aggregates of the selected economies pinpoints to some useful facts about the financial systems of these economies. In general, narrow money seems to have risen steadily over the years reflecting an increase in the transactions demand for money with economic growth. Broad money in terms of GDP seems to have increased rapidly particularly in Korea and Chinese Taipei indicating signs of rapid financial deepening in these economies. Private sector credit appears to have proliferated in the advanced economies of Korea and Chinese Taipei reaching levels comparable to those of western advanced nations with the private sector/GDP ratio for Korea reaching about 120 percent and that of Chinese Taipei at 150 percent. Indonesia, Sri Lanka and Cambodia at present appear to have similar private sector credit/GDP ratios although Indonesia seems to have had higher ratios in the late 1990's while Sri Lanka has maintained a steady pace of this indicator. Nepal has shown a rapid growth in private sector credit in the recent past with this indicator reaching a level of around 60 percent. Although Cambodia shows a rapid growth in this indicator over the years, its financial structure is at a rudimentary stage of development with the Central Bank being set up in early 1980s and the financial sector consisting largely of banking institutions.

In terms of financial deepening, the Korean and the Chinese Taipei financial systems seem to be the most advanced. A cursory glance at newer indicators of financial deepening such as those relating to financial markets would also lend support to the sophisticated nature of the financial systems of these two economies - as the financial system matures the importance of financial markets increase in relation to banks. In Chinese Taipei, increased reliance has been placed on financial markets to raise funds in the past decade as a large quantum of funds for investment has been channeled through markets rather than banks. However, notwithstanding these developments, an examination of assets and deposits of the financial systems pinpoints to the dominance of the banking sector in the financial structures of these economies (see table5).

6.1 Banking Sector Dominance

6.1.1 Korea

In Korea, the banking sector accounts for about 60 percent of all assets in the financial system while accounting for about 70 percent of all deposits. Commercial banks carry the largest share of this asset portfolio contributing about 37 percent to the share of banking sector assets. However, the proliferation of non-bank deposit taking institutions has resulted in these entities accounting for about 14 percent of all assets and 30 percent of deposits. Among non-bank

institutions, credit co-operatives account for about 10 percent of assets and 22 percent of deposits. Together, depository institutions (bank and non-bank) account for about 70 percent of all financial sector assets. The Financial Supervisory Service (FSS), an integrated regulator, supervises all financial institutions in the country.

Table 5
SEACEN Financial System Structure

Institution	Korea		Cambodia		Nepal		Sri Lanka		Chinese Taipei		Indonesia	
	Assets (%)	Deposits (%)	Assets (%)	Deposits (%)	Assets (%)	Deposits (%)	Assets (%)	Deposits (%)	Assets (%)	Deposits (%)	Assets (%)	Deposits (%)
Banking Institutions (Deposit Takers)	**58**	**70**	**100**	**100**	**90**	**92**	**65**	**94**	**63**	**81**	**79**	**100**
Commercial Banks	37	54	85	96	77.3	80	54	77	63	81	78	99
Development Banks	17	15	6	1	12.4	12	10	15	--	--	--	--
Rural Banks	4	0.7	9	2	--	--	1	2	--	--	1	1
Non-Bank Depository Institutions	14	30	--	--	8.2	7.6	6	6	12	19	6	--
Other Financial Institutions	11	--	--	--	2.2	0.5	5	--	3	--	5	--
Contractual Savings Institutions	17	--	--	--	--	--	24	--	22	--	10	--

Source: Project Team Members.

6.1.2 Cambodia

In contrast, Cambodia's financial structure appears to consist only of the banking sector with 100 percent of the assets of the financial sector in the hands of banks. The banking sector in Cambodia comprise of commercial banks, specialised banks and microfinance institutions. Commercial banks engage in lending, deposit taking and payment and settlement activities to customers. Specialised banks are only involved in lending activities while microfinance institutions engage in banking activities by way of lending and soliciting deposits although these entities are bound by certain thresholds to distinguish these institutions from banks. The dominance of the commercial banks in the Cambodian financial system is notable with 85 percent of total assets and 96 percent of all deposits belonging to commercial banks. The supervision and regulation of banks in the financial system is under the purview of the National Bank of Cambodia.

6.1.3 Nepal

The dominance of the banking sector is also seen in the Nepalese financial structure. The share of assets held by commercial banks accounts for about 77 percent of total assets of the financial system while deposits of the banking sector amount to 81 percent of the total.[26] The public ownership of commercial bank services in the Nepalese financial structure does not seem significant in terms of assets and deposit mobilisation with private sector banks accounting for 72 percent of total assets and 77 percent of all deposits in the banking industry (Nepal Rastra Bank, 2011). The Nepal Rastra Bank (NRB) regulates and supervises banks and financial institutions in the country. Commercial banks, development banks, finance companies, microfinance development banks and some co-operatives and NGOs come under the purview of the Nepal Rastra Bank. NRB is gradually adopting risk based supervision from the compliance based supervision it has been practicing with the issuance of risk management guidelines to commercial banks.

6.1.4 Sri Lanka

The banking sector dominates the Sri Lankan financial structure with assets accounting for about 65 percent of total assets in the financial system and deposits accounting for about 94 percent of the total. Within the banking sector, commercial banks play a dominant role contributing a share of 54 percent to banking sector assets while specialised banks account for the balance 10 percent. The two state commercial banks are major stakeholders in the commercial banking sector with a combined market share of about 40 percent of commercial bank credit. The two state owned banks together with four other large private commercial banks comprise the systemically important banks in the financial sector. These together accounts for about 76 percent of commercial banking assets and 64 percent of banking sector assets. The Central Bank of Sri Lanka (CBSL) regulates and supervises the banks, finance companies, leasing companies and the primary dealers.[27] The CBSL co-ordinates closely with other financial regulators to maintain a sound financial system as the CBSL is responsible for maintaining financial system stability

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26. Apart from commercial banks, the Nepalese financial structure consists of development banks, finance companies, micro finance development banks, savings and credit co-operatives, non-government organisations, citizen investment trust, the insurance sector, the Employees Provident Fund (EPF) and the Nepal Stock Exchange.

27. The other regulators are the Securities and Exchange Commission(SEC) for the supervision of the stock exchange and other financial entities and the Insurance Board for the supervision of insurance companies and brokers.

6.1.5 Chinese Taipei

The financial sector in Chinese Taipei is also dominated by banking institutions with commercial banks accounting for 63 percent of total assets in the financial sector and around 80 percent of the deposits. Domestic banks are the major stakeholders with local branches of foreign banks registering only a subdued presence. Non-bank depository institutions in the form of post companies, credit departments of farmers and fishermen's associations and credit co-operatives account for about 12 percent of total assets and the balance 19 percent of deposits. Other financial entities together contri0bute around 25 percent share to the assets of the financial sector. The Financial Supervisory Commission (FSC) supervises and regulates financial institutions in Chinese Taipei.

6.1.6 Indonesia

The Indonesian financial system is also dominated by the banking sector with assets of the banking sector accounting for nearly 80 percent of assets of the financial system. Commercial banks play a leading role with 78 percent of total assets and 99 percent of deposits while rural banks comprise only 1 percent of the asset base and nearly 1 percent of the deposit base. Non-bank depository institutions such as finance companies contribute around 6 percent of the total to the asset base while insurance companies account for about 10 percent of the asset base in the financial system. The role of non-bank financial intermediaries is rapidly growing in importance in the Indonesian financial landscape with banks owning these institutions partially or wholly. The responsibility for the regulation and supervision of the banking and insurance sectors, capital market, pension funds and other financial institutions lies with the newly established Financial Services Authority (FSA).[28] The maintenance of financial stability is monitored by a high level forum for financial stability.

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28. The FSA at present supervises financial institutions except for the banking sector which it is expected to supervise by 2014.

7. Financial Soundness Indicators in SEACEN Region

This section attempts to assess and review indicators for assessing financial stability in the SEACEN region through a comparison of Financial Soundness Indicators (FSIs) as they constitute a uniform set of indicators that can be compared across economies. As banks are key stakeholders in the financial system in the form of deposit takers, the quantitative assessment of financial stability largely concentrates on the soundness of the banking system. The paper focuses primarily on the financial condition of the banking sector in terms of profitability, solvency, asset quality and liquidity indicators. Although some indicators such as capital adequacy and the net open position in foreign exchange have some benchmark values (8 percent in the case of capital adequacy and a value close to zero for the net open position), most indicators do not have a "benchmark" as such. Therefore, the assessment focuses on the evolution of indicators over time and on comparison with other countries (Gersl and Hermanek, 2006). The analysis examines banking sector FSIs for the period 2008-2011 to make an initial retrospective assessment of the resilience of the banking sector in the SEACEN region.[29] An evaluation of the banking sector past performance can also provide a basis for a forward looking analysis. When analysing financial ratios, care must be taken to interpret such ratios against the background of the economic conditions in which they occur or the phase of the business cycle in which the economy is operating. The analysis in this section uses trend analysis which shows whether a ratio is improving or deteriorating. Where ever possible, the trend analysis is supplemented by macroeconomic data which provides an important tool for risk management.

7.1 Availability of FSIs in SEACEN Economies

Among the SEACEN economies surveyed in the paper, Korea appears to have the most comprehensive coverage of FSIs with 12 core and 15 encouraged indicators compiled and disseminated through the IMF FSI website. Although the IMF recommends the inclusion of all deposit takers for FSI purposes, the Korean FSIs cover only the domestic banks and branches of foreign banks. Deposit takers excluded from coverage account for about 29 percent of total deposit taker assets.[30] The reasons for exclusion include the different prudential rules for some of these institutions from those applicable to banks and the high

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29. The year 2008 is chosen as the starting point for the analysis as this is the earliest year for which a comparison can be made internationally.

30. See IMF website for financial soundness indicators for Korea.

cost of FSI compilation for such institutions which number over 4000. The Indonesian FSIs cover the banking sector with the FSI coverage for the banking sector accounting for 98 percent of all assets in the financial system. Deposit takers excluded from the FSI coverage for Indonesia account only for about 2 percent of financial sector assets. The Indonesian FSIs are disseminated in the IMF website for financial soundness indicators. In the case of Sri Lanka, FSIs are compiled for the banking sector and finance companies separately although both constitute deposit takers. The FSIs reported in the paper relate only to the

Table 6
FSI Availability

	Description	Indonesia	Republic of Korea	Sri Lanka	Chinese Taipei	Cambodia	Nepal
	Core FSIs for Deposit Takers (in percent, except where indicated)						
1	Regulatory capital to risk-weighted assets	√	√	√	√	√	√
2	Regulatory Tier 1 capital to risk-weighted assets	√	√	√	√	√	√
3	Nonperforming loans net of provisions to capital	√	√	√		√	
4	Nonperforming loans to total gross loans	√	√	√	√	√	√
5	Sectoral distribution of loans to total loans	√	√			√	
	Residents	√	√			√	
	Nonresidents	√	√			√	
6	Return on assets	√	√	√	√	√	√
7	Return on equity	√	√	√	√	√	√
8	Interest margin to gross income	√	√	√		√	
9	Noninterest expenses to gross income	√	√	√		√	
10	Liquid assets to total assets (Liquid Assets Ratio)	√	√	√	√	√	√
11	Liquid assets to short-term liabilities	√	√	√	√	√	
12	Net open position in foreign exchange to capital	√	√	√		√	

	Description	Indonesia	Republic of Korea	Sri Lanka	Chinese Taipei	Cambodia	Nepal
	Encouraged FSIs for Deposit takers (in percent, except where indicated)						
13	Capital to assets	√	√	√		√	√
14	Large exposure to capital	√	√			√	
15	Geographical distribution of loans to total loans	√	√				
	Domestic economy	√	√				
	Advanced economies, excluding China	√	√				
	Other emerging market and developing countries, including China	√	√				
16	Gross asset position in financial derivatives to capital	√	√				
17	Gross liability position in financial derivative to capital	√	√				
18	Trading income to total income	√	√				
19	Personnel expenses to noninterest expenses	√	√	√			
20	Spread between reference lending and deposit rates (basis points)	√	√				√
21	Spread between highest and lowest interbank rates (basis points)	√					
22	Customer deposits to total (noninterbank) loans	√	√				
23	Foreign-currency-denominated loans to total loans	√	√				
24	Foreign-currency-denominated liabilities to total liablities	√	√				
25	Net open position in equities to capital		√				

	Description	Indonesia	Republic of Korea	Sri Lanka	Chinese Taipei	Cambodia	Nepal
	Encouraged FSIs for Other Sectors (in percent, except where indicated)						
	Other Financial Corporations						
26	Assets to total financial system assets	√	√	√			
27	Assets to Gross Domestic Product (GDP)	√	√	√			
	Non financial Corporations						
28	Total debt to equity			√	√		
29	Return on equity			√	√		
30	Earnings to interest and pricipal expenses						
31	Net foreign exchange exposure to equity						
32	Number of bankruptcy proceedings initiated			√			
	Households						
33	Household debt to GDP			√	√		
34	Household debt service and pricipal payment to income				√		
	Market liquidity						
35	Average bid-ask spread in the securities market	√	√	√			
36	Average daily turnover ratio in the securities market	√	√	√	√		
	Real estate markets						
37	Residential Real Estate Prices (5 change)	√			√		
38	Residential real estate loans to total loans	√	√		√		
39	Commercial real estate loans to total loans	√	√		√		

Source: IMF Website (Korea, Indonesia),Financial Stability Reports of the CBSL and Project Team Papers (Cambodia and Nepal).

banking sector.[31] Sri Lankan FSIs are not disseminated in the IMF website at present but published in Financial Stability Reports of the Central Bank of Sri Lanka.[32] in The FSI analysis for Chinese Taipei includes those for deposit takers as well as households and markets. The FSIs are compiled in accordance to the IMF methodology (Central Bank of the Republic of China, 2012). These FSIs are not disseminated through the IMF website but published annually in the Financial Stability Report of Central Bank, Chinese Taipei. The FSIs for Nepal and Cambodia cover the banking sector and are not disseminated through a publication or website.[33] The numerical values of FSIs for the SEACEN economies under surveillance are given in Annex 1. A detailed analysis of FSIs will be done only for those FSIs that are available for comparison across the SEACEN economies under survey.

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31. In the case of Sri Lanka, FSIs presented in this report may differ from those that will be disseminated in the IMF website in the future due to differences in coverage and compilation.

32. There are plans to disseminate Sri Lankan FSIs in the IMF website in accordance to IMF compilation practices in the very near future.

33. FSIs for Nepal and Cambodia have been obtained through the Project Team Papers.

7.2 Core Indicators of Deposit Takers

7.2.1 Profitability Indicators

Profitability ratios quantify how much money a firm is able to make based on its assets or equity. In other words, these indicators show how much revenue can be converted into net income. Return on assets (ROA) describes how much profit the firm's asset base is able to produce. The ROA is calculated by dividing net income by the average value of total assets (IMF Guide, 2006). The higher the ROA, the more efficient an institution is in generating profits from its assets.

7.2.1.1 ROA(Return on Assets)

Profitability indicators for the SEACEN economies under consideration are shown in Chart 3. In the case of the surveyed SEACEN economies, ROA ratios are all positive reflecting the generation of profits out of banking sector assets. However, ROA FSIs for Korea and Chinese Taipei at around an average of 0.75 for Korea and 0.4 for Chinese Taipei respectively are comparatively lower than that of other SEACEN economies, reflecting low profitability on the face of it. ROA data for these two higher income economies in the SEACEN region is comparable to such FSIs in advanced economies. For instance, in the USA and UK the comparable ROA indicators are around 0.2 - 0.3 percent. An explanation for this phenomenon may be that banks in Korea and Chinese Taipei face stiff competition.

Chart 3
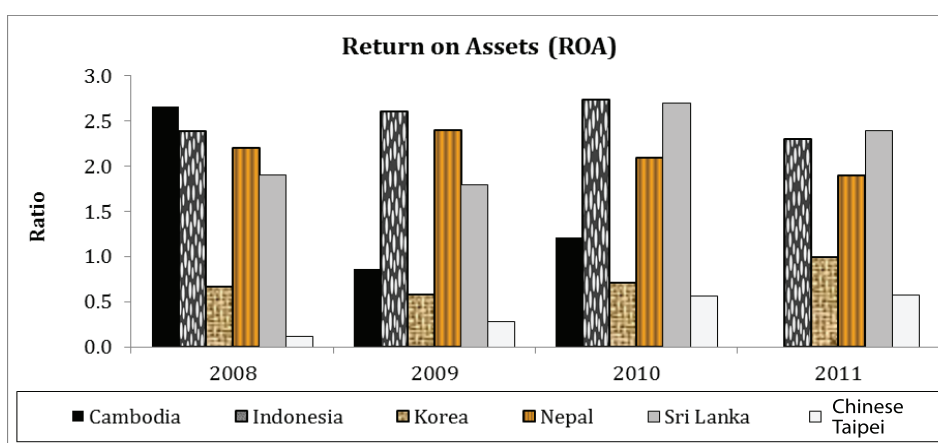
Source: IMF (Korea, Indonesia), CBSL and Project Team Papers (Nepal, Cambodia, Chinese Taipei).

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Therefore, the seemingly lower ROA profitability indicators for Korea and Chinese Taipei may not be indicative of a less efficient banking sector in these economies. Economies such as Indonesia, Korea, Sri Lanka and Chinese Taipei show improved profitability for the banking sector in terms of the ROA indicator from 2008 to 2011 reflecting improved economic conditions during the years 2010 and 2011 in particular, in comparison to generally lower ROA indicators seen during the economic downturn experienced in 2008 and 2009.

The analysis of profitability indicators relies on major external economic developments and financial sector conditions. Data on cyclical monetary and financial market conditions together with asset price developments are helpful in analysing profitability conditions. Monetary policy can impact the profitability of the banking sector through changes made to the official interest rates. A lowering of policy rates may result in lower market interest rates thus reducing net income and the profitability of the banking system. Growth rates in interest bearing assets and liabilities and banks margins are the key drivers of banks net interest income (Morttinnen et al, 2005). Current profitability depends on activities undertaken by banks in the past.

Chart 4
Profitability and GDP Growth
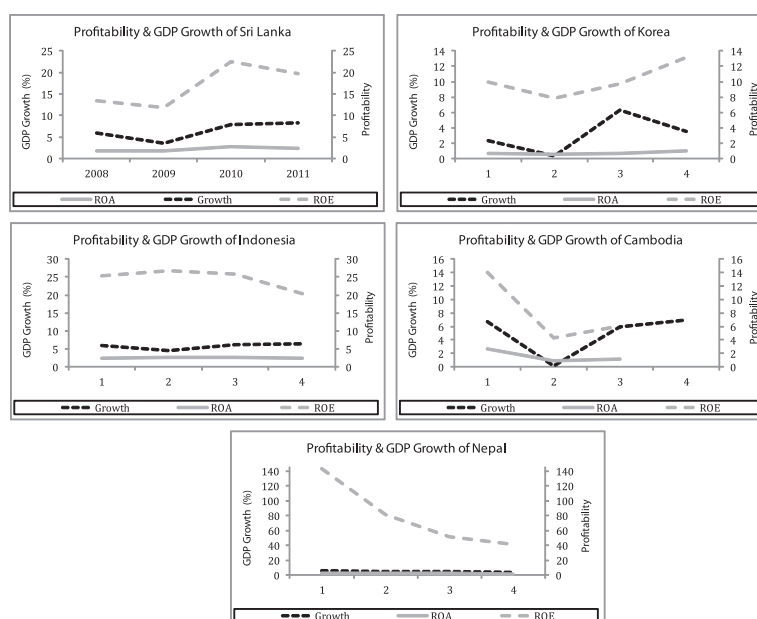
Source: IMF (Korea, Indonesia), Central Bank of Sri Lanka and Project Team Papers (Nepal, Cambodia, Chinese Taipei).

33

The relationship between profitability indicators and the business cycle has been well documented (Rita Babihuga, 2007). Chart 4 shows the relationship between GDP growth and profitability indicators in the form of ROE and ROA FSIs for the SEACEN economies under consideration. GDP and ROE indicators appear to be procyclical for Korea, Indonesia, Cambodia and Sri Lanka moving in tandem with the growth momentum of the economy. When GDP growth declines, the ROE is also lower with the converse taking place with a pick up in the GDP growth rate. However, when GDP growth declined in Korea in 2011, ROA and ROE indicators seemed to improve while in Indonesia ROE and ROA appeared to decline in 2011 with an increase in GDP growth. In the case of Nepal, the procyclicality of the business cycle and the profitability indicators does not seem to hold. The 'driving force' of economic growth for profitability measures such as ROE can be clearly seen for export oriented economies such as Korea, Chinese Taipei and Sri Lanka which depend on external demand for high economic growth.

7.2.1.2 *ROE (*Return on Equity)

Return on equity (ROE) measures the efficiency with which profits are generated from a firm's equity base. As with ROA, the higher the indicator, the more effective the firm is in terms of generating profits. ROE indicators for the period 2008 to 2011 in respect of the examined economies show healthy profitability levels. As in the case of ROA, the ROE FSIs for Korea and Chinese Taipei are lower in numerical value averaging at around 10.1 per cent for Korea and 6.2 per cent for Chinese Taipei for the period 2008 – 2011 respectively. These indicators are similar to those observed in advanced economies such as the USA and UK. The ROE for Cambodia indicates comparatively high values for the period 2006 to 2008 reflecting strong economic growth during this period together with very high levels of credit growth amounting to 76 percent recorded prior to the global crisis in 2007. Nepal shows a very high ROE ratio of 143.6 in 2008 although this ratio declines thereafter. ROEs generally show an improvement from 2008 to 2011 except for Cambodia, Indonesia and Nepal.
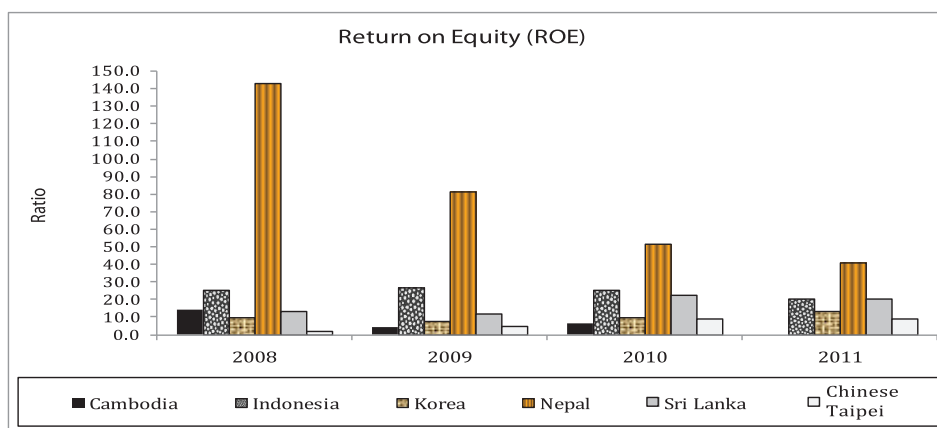
34

Chart 5

Return on Equity (ROE)

Legend: Cambodia, Indonesia, Korea, Nepal, Sri Lanka, Chinese Taipei

Although ROE and ROA indicate the net result of financial operations in the banking sector during a certain period, these profitability ratios do not really reflect the cost of capital in comparison to alternative investments. In order to show the real profit of the banking sector, these profitability ratios can be adjusted by deducting an assumed cost of capital such as that incurred on investment in risk-free government securities (Greuning and Bratanovic, 2009). By comparing ROE with the after tax return on government securities, it is possible to determine whether equity invested in the banking sector yield additional returns as compared to risk-free investments. The adjusted profitability level is shown for Sri Lanka in Table 7.

Table 7
Adjusted ROE
(Ratio)

Economy	2008	2009	2010	2011
Korea				
Household Debt to GDP	83.9	85.9	85	89.2
Chinese Taipei				
Household Debt to GDP	81.9	84.7	82.1	82.6
Debt Service Payments to Disposable Income	40.72	36.8	36.07	36.4

As can be seen from Table 7, adjusted return on equity for the Sri Lankan banking sector remained negative during 2007 and 2008 with very high Treasury bill yield rates recorded during this time period in the wake of fiscal deficits reaching about 7 percent of GDP. From 2010 onwards, adjusted ROE data reflect positive real returns from equity investments in the banking sector in comparison to investments in the government securities market.

Chart 6
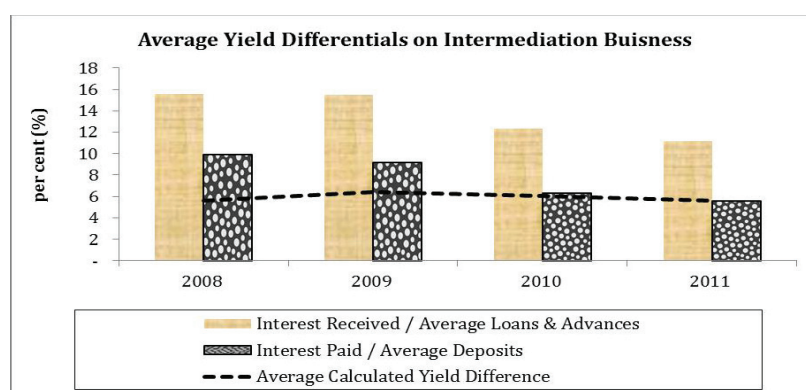
Source: Central Bank of Sri Lanka.

An examination of the average yield differentials on intermediation business (chart 6) shows the profitability of the primary function of intermediation for banks in Sri Lanka. The calculated average yield difference for intermediation business in Sri Lanka remains at attractive positive levels with the interest received on loans and advances always exceeding the interest paid on deposits. The difference in the yield rates are maintained at a positive 5-6 percent range throughout the period 2008 to 2011 reflecting the profitability of the banking sector.

7.2.1.3   Interest Margin to Gross Income FSI

A key indicator of profitability is net interest income which is computed as the surplus of interest income over interest expenses. Therefore, profitability of the banking sector can also be measured in terms of income and expense based FSIs such as interest margin to gross income and non-interest expenses to gross income. Chart 7 shows the interest margin to gross income FSI for the SEACEN economies in the study.
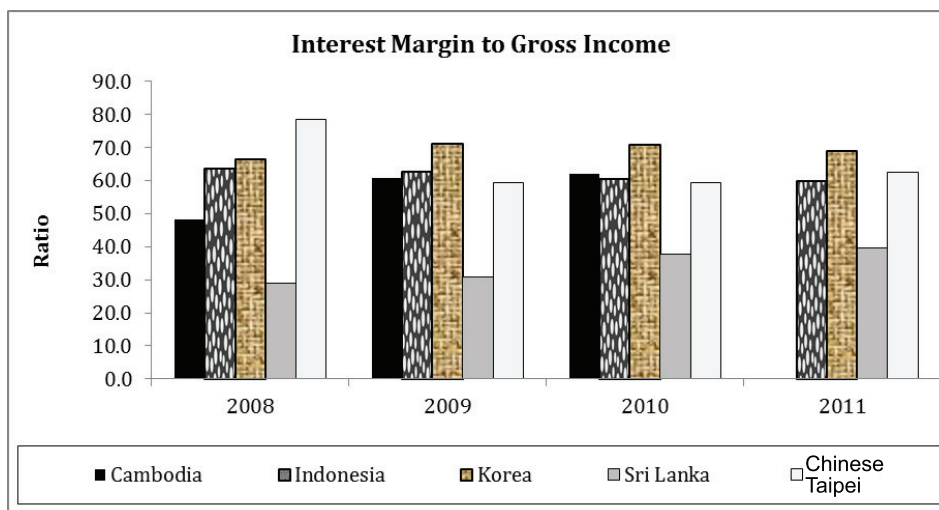
36

Chart 7

Interest Margin to Gross Income

Source: IMF (Korea, Indonesia), Central Bank of Sri Lanka and Project Team Papers (Nepal, Cambodia, Chinese Taipei).

Interest margin to gross income measures the relative share of net interest earnings, i.e., interest earned less interest expenses in comparison to gross income. Most SEACEN economies under survey have high interest margins exceeding 50-60 in numerical value. The average interest margin to gross income for Indonesia, Korea and Chinese Taipei stood at 61.6, 69.3 and 65.1 percent respectively from 2008 to 2011. In the case of Cambodia, the average interest margin amounted to 59 percent while Sri Lanka's interest margin to gross income FSI reflects a lower value at an average of 34.2 percent.

Differences in interest margins and profitability can arise due to a variety of reasons such as bank characteristics, explicit and implicit bank taxation, deposit insurance regulation, legal and institutional factors (Demirguc-kunt and Huizinga, 1998) and even the profitability of the intermediation business. The lower ratio observed for Sri Lanka can be attributed to factors such as taxation and reserve requirements. In particular, Sri Lankan banks during this period were subject to high rates of taxation with an overall tax rate of about 50 – 60 percent imposed on these institutions in the form of mainly direct taxation such as corporate taxes and other taxes such as the value added tax. Moreover, Sri Lankan banks are also subject to indirect taxation through unremunerated reserve

requirements amounting at present to 8 percent of demand deposits. Reserve requirements become an implicit tax on banks when they are remunerated at less than market interest rates (Demirguc-kunt and Huizinga, 1998).[34]

7.2.1.4 Non-Interest Expenses to Gross Income

Another profitability indicator that can examine the efficiency of the banking sector is the FSI non-interest expenses to gross income. Chart 8 shows this FSI for the economies of the SEACEN region.
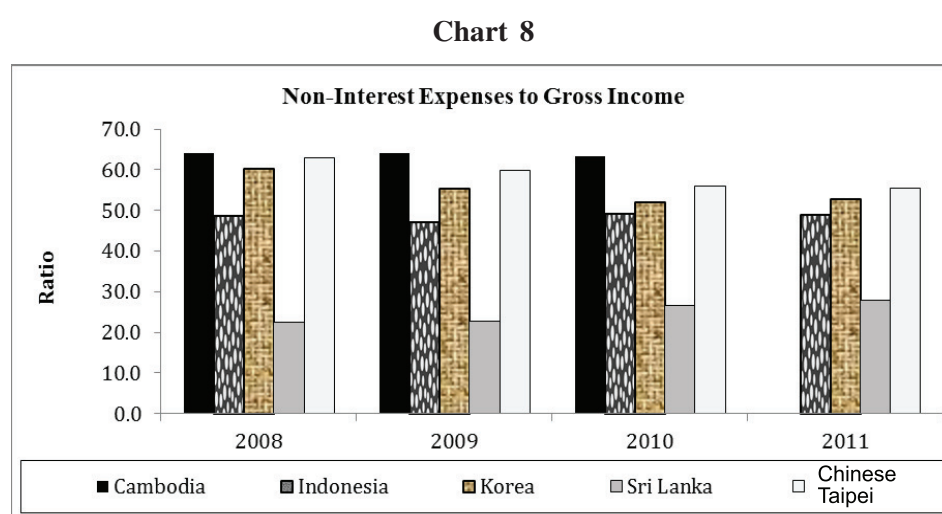
Chart 8

Source: IMF (Korea, Indonesia), Central Bank of Sri Lanka and Project Team Papers (Nepal, Cambodia, ChineseTaipei).

This FSI measures the size of administrative expenses to gross income. The numerator includes expenses such as personnel costs while gross income, which is interest margin added to non-interest income, constitutes the denominator. Chart 8 shows this FSI to have high values for the higher income SEACEN economies such as Korea and Chinese Taipei. The average values for Korea and Chinese Taipei for this indicator amount to 55.1 percent and 58.6 percent

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34. Demirguc-kunt and Huizinga (1998) differentiate the corporate tax and the reserve requirement as a direct tax and an indirect tax respectively. As the corporate income tax is targeted at pure profit, it is seen to be relatively undistortionary. However, as the reserve requirement is imposed on the volume of deposits taken, it is seen as a distortionary tax. Accordingly, from a welfare perspective, corporate tax appears to be superior to a reserve tax.

respectively for the period 2008 to 2011. Indonesia also displays a relatively high value for this FSI with an average of 48.5 percent for the period under consideration. However, in the case of Sri Lanka, the non-interest expense to gross income ratio reflects a relatively low value with the average at around 25 percent from 2008 to 2011. This reflects the importance of interest income for the banking sector in Sri Lanka.

7.2.2   *Capital Adequacy*

Capital is required as a buffer against unexpected losses. Capital adequacy indicators measure the extent to which a banking system is able to withstand shocks or absorb losses. The two capital adequacy ratios used in the paper - regulatory capital to risk-weighted assets and regulatory tier I capital to risk weighted assets - are based on the definitions of capital as used in the Basel Capital Account.

7.2.2.1   *Regulatory Capital to Risk Weighted Assets FSI*

The regulatory capital to risk weighted assets FSI has regulatory capital as the numerator and risk weighted assets as the denominator. The capital adequacy ratio can change due to a change in the numerator or the denominator of the ratio. In order to increase the ratio, banks may increase Tier I or Tier II capital by not distributing dividends or issuing equity or subordinated debt. Similarly, risk weighted assets which comprise the denominator can also be altered by cutting back on loan growth or shifting into assets with lower risks such as movement from corporate loans to government securities.

A comparison of regulatory capital to risk weighted FSI indicators for the surveyed SEACEN economies shows all banking sectors meeting the minimum capital adequacy requirement of 8 percent (except for Nepal which has a 4 percent and 7.2 percent values for 2008). While Nepal registers values generally lower than other SEACEN economies with an average capital adequacy value of 6 percent for the period 2008 – 2011, Cambodia shows very high capital adequacy ratios, with the average value registering around 30 percent during the period 2008-2010. In Nepal, the capital adequacy ratio increased steadily over time reflecting the build-up of enhanced buffers over time. Indonesia, Korea, Sri Lanka and Chinese Taipei show regulatory capital to risk weighted assets FSIs averaging at around 16.9, 13.8, 15.7 and 11.7 percent respectively during this period.

Chart 9
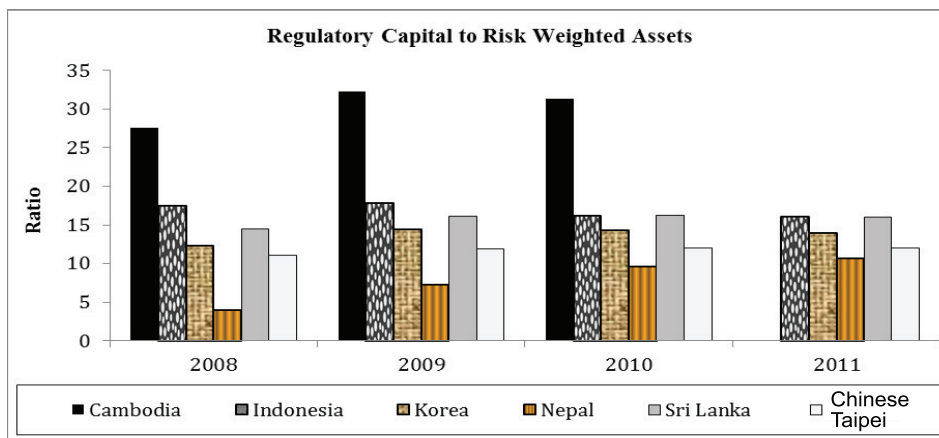
Source: IMF (Korea, Indonesia), Central Bank of Sri Lanka and Project Team Papers (Nepal, Cambodia, Chinese Taipei).

An analysis of the structure of capital for the SEACEN economies Indonesia, Korea and Sri Lanka shows that the banking sectors of these economies are well capitalised. The structure of capital for these three countries is shown in Chart 10. As can be seen, all three banking sectors are well capitalised.

Chart 10
Structure of Capital
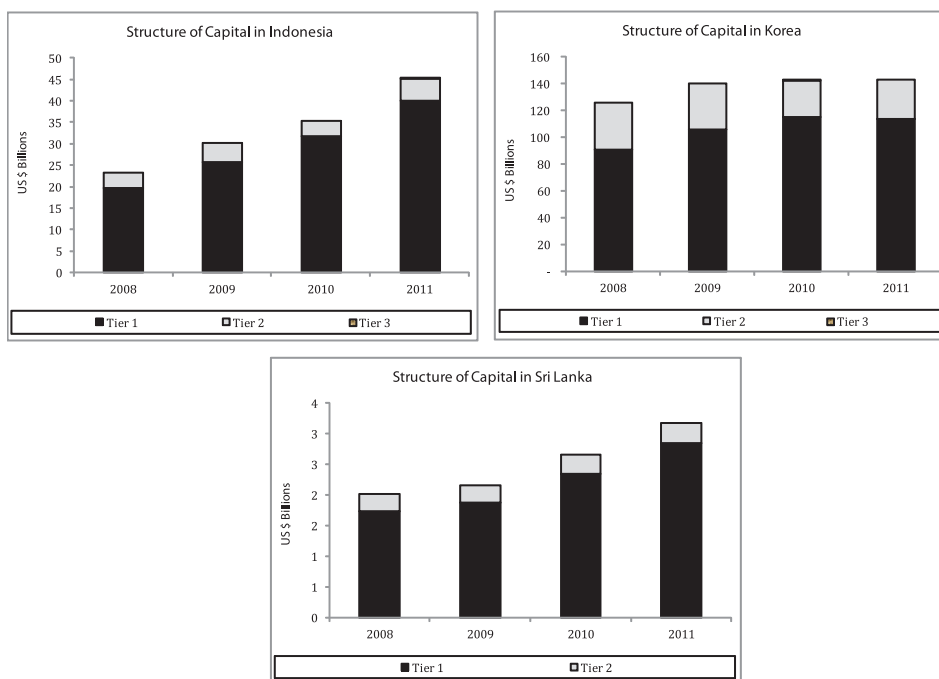
Source: IMF (Korea, Indonesia) and Central Bank of Sri Lanka.

A further analysis of the core capital strength (Chart 11) supports the capital adequacy of the three banking sectors. Tier 1 capital consisting of core capital components such as common stock and retained earnings account for well above 50 percent of the total capital. In the case of Indonesia, Tier 1 capital accounted on average for about 91 percent of the total regulatory capital with the core capital component increasing from 88 percent in 2008 to 93 percent in 2011. Korea has on average a core capital component of 81 percent for the period under consideration with this component rising from 78 percent in 2008 to 83 percent in 2011. Sri Lanka's Tier 1 capital averages at around 88 percent for the period under consideration with this quantum increasing from 86 percent in 2008 to 90 percent in 2011. The foregoing analysis clearly shows the move towards enhancing capital buffers in these economies.

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Chart 11

Core Capital Strength- Tier 1 As a Percentage of Regulatory Capital
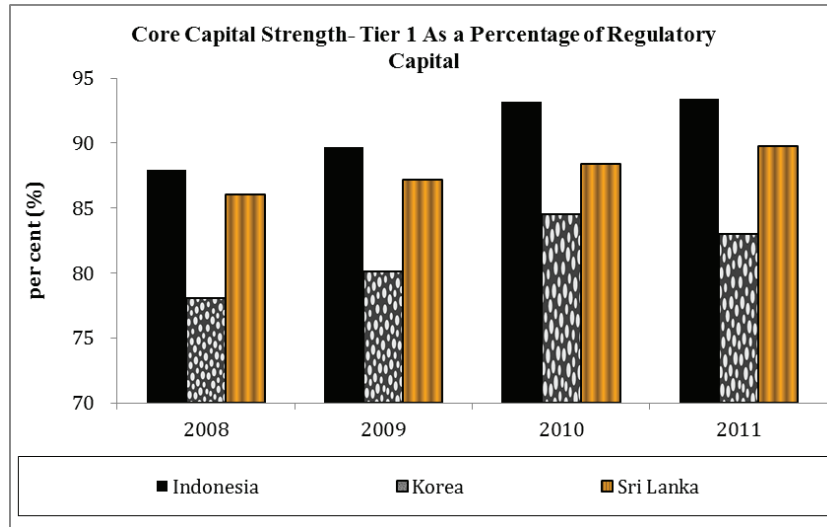
Source: IMF (Korea, Indonesia) and Central Bank of Sri Lanka.

A graphical representation of risk weighted assets for the banking sectors of Korea, Indonesia and Sri Lanka reflects the differences in the banking sectors of the three economies in respect of their credit conditions.

Chart 12

Risk Weighted Assets
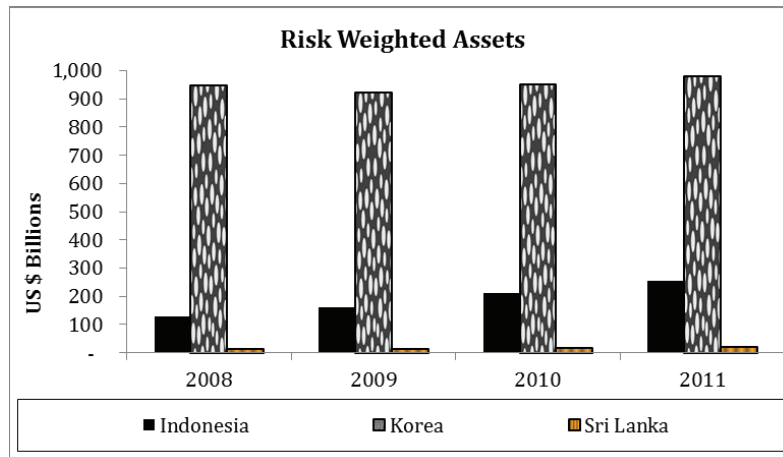
Source: IMF (Korea, Indonesia) and Central Bank of Sri Lanka.

An analysis of actual capital vs. required capital for the banking sector in Sri Lanka (chart 13) shows that there is an excess of capital over the required level. The maintenance of a capital adequacy ratio of on average 16 percent for the period 2008 to 2011 reflects the excess capital available for banks over the international requirement of 8 percent.

Chart 13
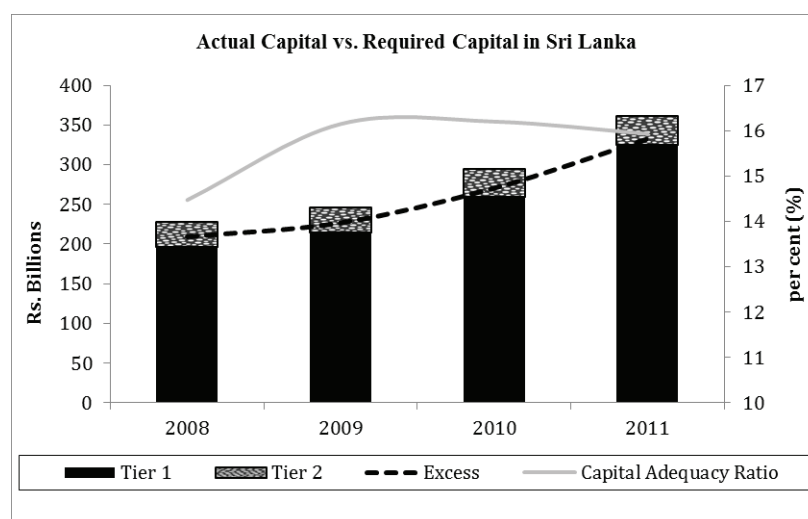
Source: Central Bank of Sri Lanka.

7.2.3   Asset Based FSIs

Shocks generated by macroeconomic variables can result in a deterioration in the condition of a financial institution particularly through an impairment of assets. The worsening financial position of borrowers, such as the household sector can result in increasing the credit risk of a bank. Credit risk refers to the inability of borrowers to repay debt.

Banks generally resort to three kinds of policies to limit credit risk (Greuning and Bratanovic, 2009). One set of policies aim at reducing or limiting credit risk. Such policies involve looking at exposure to a single customer, related party financing and overexposure to a geographic area or sector. The second set of policies aim at classifying assets. This entails a periodic evaluation of the credit portfolio to assets, the likelihood of repayment of credit and the adequacy of the loan portfolio classification. Under this set of policies, a close watch is kept on non-performing assets. The third set of policies deal with

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provisioning issues with a view to providing adequate allowances to absorb anticipated losses.

Monitoring of asset quality, therefore, through indicators relating to non-performing loans (NPLs), concentration of the loan portfolio to specification sectors, borrowers and currencies etc., is an important aspect of risk management in a bank. In a boom period, banks may lend to sub-standard borrowers in the wake of good economic conditions. In order to assess future vulnerabilities arising from 'bad' and excessive lending behavior of loans, monitoring of credit becomes invaluable since problematic loans start materialising only 2 – 3 years after the loans has been granted. Although numerous indicators are used for assessing credit risk, this report restricts the usage to a few indicators such as NPLs and the distribution of loans due to data limitations.

7.2.3.1 Non-Performing Loans to Gross Loans

An FSI that identifies asset quality problems in the loan portfolio is the ratio of non-performing loans to gross loans. This FSI is calculated by taking the value of NPLs as the numerator and the total value of the loan portfolio (including NPLs and before the deduction of specific loan loss provisions[35]) as the denominator. An increasing value is indicative of a deterioration in the loan portfolio. This FSI is a backward looking indicator as bad loans emerge some time after they are granted.

Chart 14
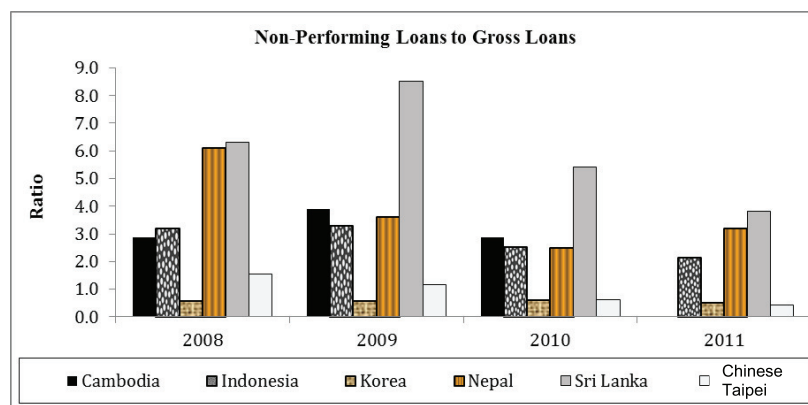
Source: IMF (Korea, Indonesia), CBSL and Project Team Papers (Nepal, Cambodia, Chinese Taipei).

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35. See IMF Guide (2006).

Non-performing loans to gross loans for the SEACEN region are shown in Chart 14. NPL ratios are highest for Sri Lanka with an average value of 6 percent for the period 2008 to 2011. The highest ratio of 8.5 percent can be seen in 2009. The high NPL ratio for Sri Lanka in 2009 can be attributed to high interest rates prevailing in the market, the adverse impact of the global crisis on the domestic economy and the lagged effect of high credit growth during the years 2007 and 2008. Nepal's NPL ratios have declined from 6.2 percent in 2008 to 3.2 percent in 2011. A substantial portion of the Nepalese NPL ratio is due to the portfolio of public banks in the country. In 2011, public banks carried a NPL ratio of 8.3 percent while private banks accounted for only 1.9 percent of the total (Nepal Rastra Bank, 2012). Moreover, Non-banking Assets (NBAs) of public commercial banks in Nepal at Rs.526 million and Rs.634 million for 2011 and 2010 respectively, as against zero levels for private commercial banks, also reflect the high NPL ratio of public banks in the country.[36] Cambodia and Indonesia have NPL ratios averaging at around 3.2 percent and 2.8 percent respectively for the period 2008 – 2011. In the case of Cambodia, the increase in the NPL ratio from about 3 percent in 2008 to nearly 4 percent in 2009 reflects the worsening conditions of the global economy for the foreign exchange earning garment and tourism industries in Cambodia. The NPL increase also reflects the introduction of a new guideline at the beginning of 2009 on credit classification, which prescribed more stringent criteria for the recognition of problem assets (SEACEN, 2011). Chinese Taipei and Korea, higher income economies in the SEACEN region, have the lowest NPL ratios averaging at around 0.9 percent and 0.6 percent respectively during 2008 to 2011.

7.2.3.2 *Sectoral Distribution of Loans*

The sectoral distribution of loans for Sri Lanka is shown in Chart 15.[37] Construction (14 percent), trade activities (11 percent), manufacturing (12 percent) and agriculture (13 percent) are the major sectors to which credit was channeled in 2011. Over time, the share of credit going to these sectors, in particular, the construction sector, has not significantly changed laying to rest financial stability concerns, particularly with regard to housing price bubbles. However, the "other customers" category in the distribution of loans, which include pawning activities, show an increase from 26 percent of the total credit in 2008 to 30 percent in 2011.[38] As credit disbursed for pawning purposes use

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36. Non-Banking Assets (NBAs) refer to assets taken over by banks with the recovery of loans .

37. Data limitations restrict the analysis of sectoral distribution of loans to Sri Lanka only.

38. "Other customers" include other lending as well in addition to pawning. The exposure of the banking sector to pawning is about 13 percent of total loans and advances.

Chart 15

Sectoral Distribution of Loans in Sri Lanka

Legend:
- Agriculture & Fishing
- Manufacturing
- Tourism
- Transport
- Construction
- Traders
- New Economy
- Financial & Buisness Services
- Infrastructure
- Other Services
- Other Customers
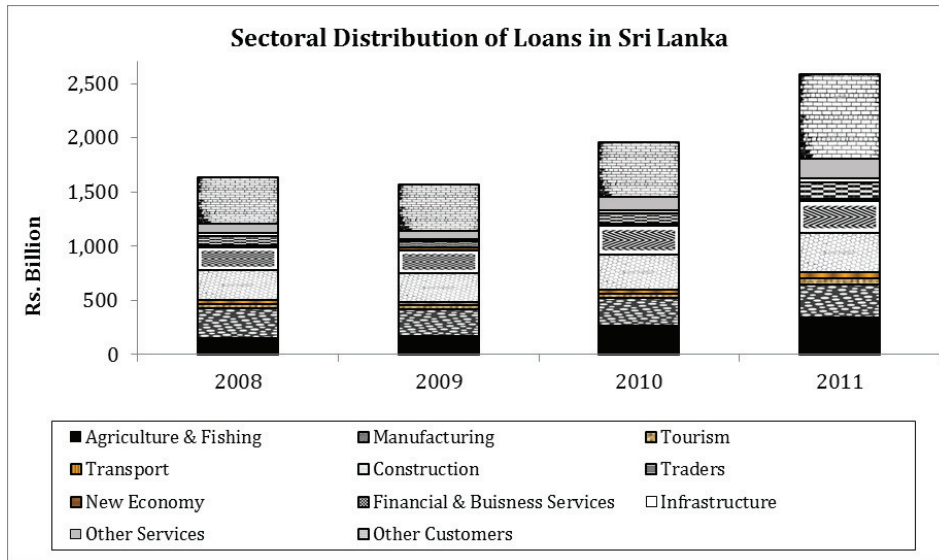
Source: Central Bank of Sri Lanka.

gold based articles for collateral, the exposure of banks to volatility in gold prices has increased significantly. This in turn raises financial stability concerns where credit growth in relation to pawning activities needs close monitoring. The use of land as collateral for a substantial portion of loans and advances of a financial institution can also have adverse implications in terms of financial stability. In Nepal, around 85 percent of loans and advances granted use property as collateral (Nepal Rastra Bank, 2011). This pinpoints to a stability issue as real estate prices which are subject to volatility can exert a huge impact on bank balance sheets. Therefore, it is imperative to monitor real estate prices in Nepal in order to mitigate adverse repercussions on the banking sector.

7.2.4 Liquidity Indicators

Liquidity management is an important part of a bank's risk management process. Maintaining a certain liquidity position is important for banks to meet expected and unexpected balance sheet fluctuations. Banks are inherently vulnerable to liquidity risk as their primary business revolves around maturity transformation by way of converting short-term deposits to long-term assets such as loans. This maturity transformation process always exposes banks and financial institutions to liquidity risk. The maintenance of an adequate liquidity position enables a bank to fund increases in assets and meet obligations as they

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come due without incurring unacceptable losses (Greuning and Bratanovic, 2009). Moreover, liquidity shortages in one systemically important bank can also lead to system wide failures in the banking sector. At the same time, the maintenance of an excessive liquid assets position can also curtail banking activities undermining profitability. Therefore, effective risk management helps banks manage their cash-flow requirements.

7.2.4.1 Liquidity Asset Ratio

A key Financial Soundness Indicator (FSI) for liquidity risk assessment, the Liquid Asset Ratio, provides an indication of the liquidity available to meet foreseen and unforeseen demands for cash. This FSI is calculated using liquid assets as the numerator and total assets as the denominator.[39] Assets that can be included in the numerator of this measure are currency, short-term deposits and securities that can be easily converted to cash. In the case of securities, the liquidity would depend on the liquidity of the secondary market where the security is traded. The denominator comprises total assets which consist of non-financial and financial assets.

Chart 16
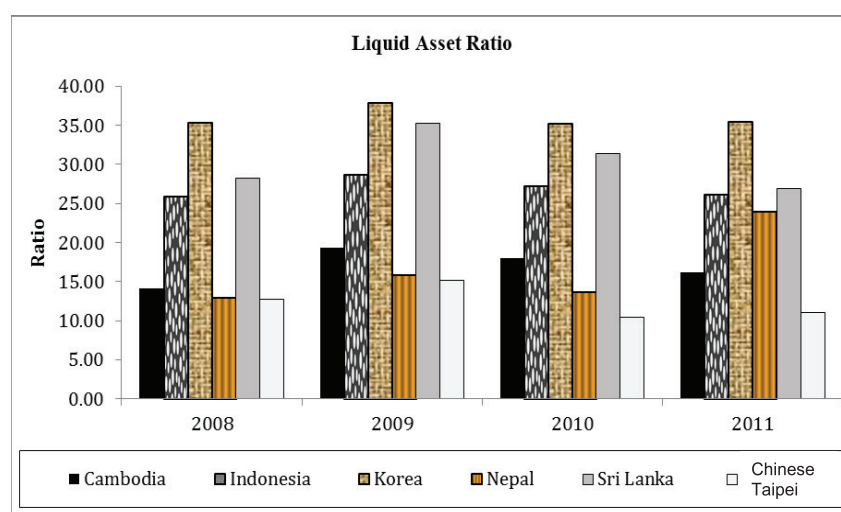
Source: IMF(Korea, Indonesia), CBSL and Project Team Papers (Nepal, Cambodia, Chinese Taipei).

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39. The numerator for this indicator can take the form of ''core liquid assets" which comprise currency and demand deposits and securities which can be easily converted in to cash form or a broad measure of liquidity which takes into account more illiquid forms of securities (see IMF Guide, 2006).

The Liquid Asset Ratios for the SEACEN economies surveyed are shown in Chart 16. As can be seen from the chart, liquidity buffers have been adequately maintained for the economies under scrutiny. Korea seems to have the highest liquid asset ratio averaging at around 36 percent for the period under consideration. Chinese Taipei's, which average at around 12 percent, is comparatively low. Sri Lanka's liquid asset ratio averaging at around 30.5 percent for the period under consideration, is well above the statutory minimum 20 percent liquid assets requirement enforced under the banking supervisory regulations of the country. However, the liquid asset ratio in Sri Lanka has declined to 26.9 percent in 2011. Indonesia, has on average, maintained a liquid asset ratio of 27 percent as compared to a requirement of 8 percent under the supervisory framework. Nepal has also maintained, on average, a liquid asset ratio of 25.5 percent during the period under review.

The stability of a bank's deposit structure and its potential for loan expansion can determine the quantum of liquid assets that a bank requires to hold. A comparison of a bank's liquid assets and its deposit base can give an assessment of the liquidity position. Chart17 shows the credit to deposit ratio of a number of economies. The credit to deposit (CD) ratio shows how much a bank lends out of the deposits mobilised. In other words, the ratio indicates how much of a bank's core funds are being used for lending.

A higher ratio indicates more reliance on deposits for lending. A high ratio can also indicate pressure on resources while a low ratio is indicative of banks not making full use of their resources. In the case of Sri Lanka, a lowering of the liquid asset ratio in 2011 is accompanied by acceleration in the credit to deposit ratio reflecting a growth in credit and a reduction in the surplus liquidity situation. A high ratio in the case of Sri Lanka can create problems for banks as banks are required to set aside funds for a statutory reserve requirement of 8 per cent and a statutory liquidity ratio of 20 percent. Similarly, a comparison of deposits against non-interbank loans will also give an indication of the potential liquidity risk faced by a financial institution.

Chart 17
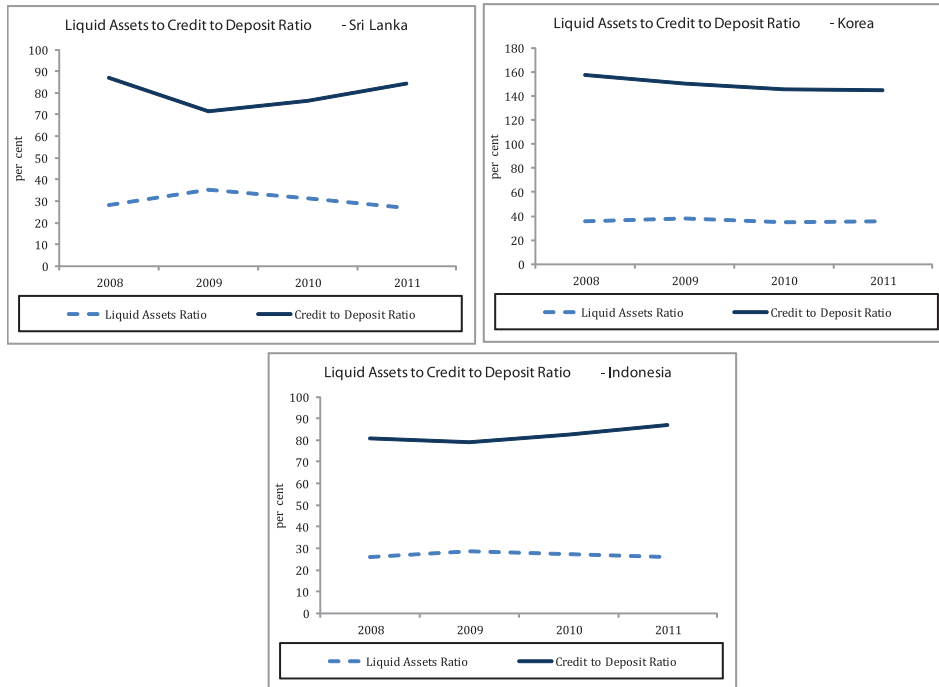
Source: IMF (Korea, Indonesia) and Central Bank of Sri Lanka.

7.2.4.2   *Liquid Assets to Short Term Liabilities*

Another indicator that reflects the liquidity position of a bank is the liquid assets to short- term liabilities ratio. This indicator for the SEACEN economies under consideration is available for Korea, Chinese Taipei, Indonesia and Cambodia. The highest ratios are seen for Korea with liquid assets to short term liabilities increasing from 101 percent in 2008 to 109 percent in 2011. This ratio for Chinese Taipei is comparatively lower at 15.7 percent in 2011. Cambodia and Indonesia maintain similar ratios at around 25 to 30 percent.

Chart 18
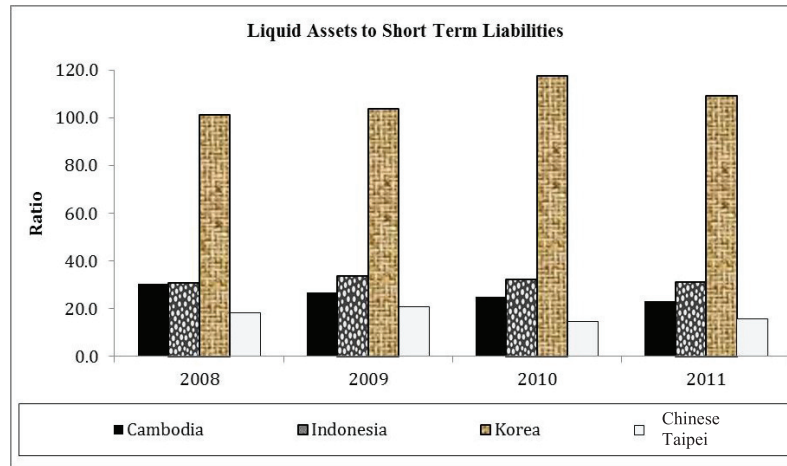
Source: IMF (Korea, Indonesia) and Project Team Papers (Chinese Taipei and Cambodia).

7.2.5 Market Risk Indicators

Market risk can be defined as the volatility of income arising from fluctuations in underlying movements in market prices in fixed income instruments, equity investments, commodities, currencies and off-balance sheet items such as derivatives. Accordingly, market risk arises due to movements in interest rates, equity prices, commodity prices and exchange rates. A high share of investments in volatile assets may signal a high degree of vulnerability in the event of price fluctuations of those assets.   As financial institutions are increasingly diversifying away from their traditional intermediation function towards market making and trading activities, market risk can have a significant impact on the assets and liabilities of a financial institution. Indicators of interest rate risk can be examined by looking at the duration of assets and liabilities and a gap analysis while in countries where banks are allowed to trade in stock markets and commodity markets, equity risk and commodity risks can be gauged by indicators for equity risk exposure such as the net open position in equities. In the case of currency risk, the indicator net open position in foreign exchange to capital can be examined to look at an institutions' exposure to foreign exchange risk.

Currency risk arises due to a change in the exchange rate of foreign currencies vis-à-vis the domestic currency. When assets and liabilities are valued in terms of foreign currencies, currency risk can occur when there is a mismatch or an open position in the asset and liability positions of a banks' balance sheet.

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Large open foreign exchange positions and a high reliance on foreign borrowing (particularly of short term maturity) can subject financial institutions to a high degree of vulnerability to exchange rate movements and capital flows. In the case of a net long position in foreign currency, the depreciation of the domestic currency will result in a net gain to the financial entity while domestic currency appreciation will incur a loss. In the case of a short position, exchange rate movements will have the opposite effect. In examining market risk indicators, the paper looks at the foreign exchange exposure of the SEACEN economies under study as the net open position indicator appears to be the most common available indicator to examine currency risk.

7.2.5.1 Net Open Position in Foreign Exchange to Capital

The FSI net open position in foreign exchange to capital identifies a deposit takers' exposure to exchange risk in relation to capital. The net open position limit is an aggregate limit on a banks' foreign currency exposure. As stipulated in the FSI guide, foreign currency items are both thosepayable (receivable) in a currency other than the domestic currency (foreign currency denominated) and those payable in domestic currency but with the amounts to be paid linked to a foreign currency (IMF, 2006). The open position is derived by summing the foreign currency positions of all foreign currency items.[40]

Chart 19

Net Open Position in Foreign Exchange to Capital
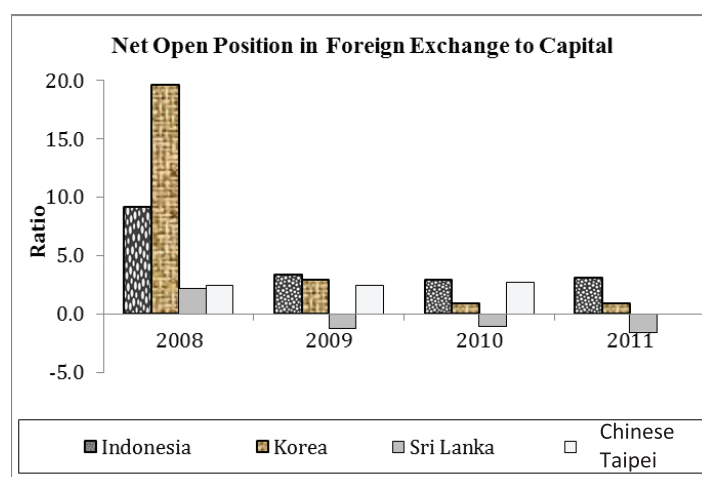
Source: IMF (Korea and Indonesia), CBSL and Project Team Papers (Chinese Taipei).

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40 . See (IMF, 2006) for compilation methodology of net open position.

Net open positions in foreign exchange to capital indicator for the SEACEN economies under review appear to be available for only five economies – Chinese Taipei, Korea, Indonesia, Sri Lanka and Cambodia. All economies except Sri Lanka show positive open positions in terms of this indicator. Chinese Taipei and Indonesia have positive balances in 2008 with 2.4 percent and 9.2 percent respectively with a declining trend in this indicator thereafter. The Cambodian banking sector shows a positive balance of 3.4 percent in 2011 from 0.9 percent in 2008 reflecting the substantial inflow of foreign currency in to the economy. Korea shows a relatively high positive net open position of 19.6 percent in 2008. Prior to 2008, before the Lehman crisis, short-term capital flowed into Korea on a large scale which enabled the Korean banking sector to maintain a very high open position in foreign currency. However, the Lehman crisis brought about large scale outflows of foreign currency immediately, causing a foreign currency liquidity crisis in the Korean banking system. The impact of the large capital outflows is seen in the lower positive net open position in the banking sector after 2008. Although medium- and long-term inflows have since steadied, such flows have also moderated in response to the euro crisis. Heightened concerns with regard to the global economic slowdown necessitates a close monitoring of capital flows as these can impact adversely on financial stability. Sri Lanka, in contrast, has a negative net open position reflecting an excess of foreign liabilities over foreign assets. In 2008, Sri Lanka's net open position indicator showed a positive position reflecting inflows of foreign currency particularly in to the bond and equity market. Since then, the banking sector has been encouraged to obtain foreign borrowings, which have been lent in domestic currency, particularly to SOEs. This has resulted in an increase in net foreign liabilities in the banking system which has made the banking sector vulnerable to a depreciation of the currency.[41]

7.3 Encouraged Indicators for Other Sectors

7.3.1 Real Estate Market Indicators

Real estate markets can be a source of instability for the financial system as shown by experience. Episodes of financial crises in the past have been caused or amplified by downturns in the real estate sector which have spilled in to the financial sector via financial sector balance sheets. As real estate is

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41. The depreciation of the currency that took place in 2011 and 2012 has increased the liability position of banks resulting in a higher negative net foreign assets (NFA) of the banking sector.

subject to severe boom and bust price cycles, the concentration of real estate in the balance sheets of financial institutions warrants close monitoring of real estate indicators. Financial soundness indicators monitoring the real estate sector include real estate price indices and real estate loans to residential and commercial sectors. Real estate markets allow the trading of claims on, and investments in, real estate and can also involve markets associated with the financing of real estate (IMF, 2006).

7.3.1.1 Housing Price Indices

Housing price indices are an essential ingredient in monitoring financial stability as financial institutions generally have large exposures (directly and indirectly) to real estate and are thus affected by the volatility in housing prices. Moreover, real estate is a store of wealth to the household sector with real estate assets as they also used to obtain loans from financial institutions. Therefore, housing price movements are also of concern to the household sector. In an open economy, international capital flows in to or out of the real estate sector can impact price volatility in this market while domestic credit, which is channelled to this sector through expansionary monetary policy or loose credit standards, can also fuel a credit led bubble in the housing market.

7.3.1.2 Residential Real Estate Loans to Total Loans

A Financial Soundness Indicator that can identify a deposit takers' exposure to the real estate market is the residential real estate loans to total loans indicator which focuses on household borrowers. The price behaviour of real estate has boom and bust characteristics where expansionary monetary policies or relaxed credit standards can lead to a rapid rise in property prices. The subsequent bust of the property house bubble results in house owners having difficulty in meeting their mortgage or loan payments, which in turn can lead to problems for financial institutions by way of default in interest and principle repayments. Moreover, the rapid fall in housing prices in a bust cycle results in a fall in the value of residential real estate collateral which can also expose financial institutions to a reduction in the collateral value in the balance sheets of financial institutions. Therefore, in order to monitor the exposure of financial institutions to the real estate market, it is important to have information regarding the size of credit exposures of household borrowers. The FSI residential real estate loans to total loans tracks this information. The FSI is calculated by taking residential real estate loans as the numerator and gross loans as the denominator (IMF, 2006).

7.3.1.3 *Commercial Real Estate Loans to Total Loans*

The FSI commercial real estate loans to total loans similarly measures the financial institutions' exposure to the commercial real estate market. The concerns raised with regard to residential loans also apply to commercial loans although the economic impact of a downturn in commercial property prices may not be so widespread in the economy. The numerator for this FSI consists of loans collaterised by commercial real estate, loans to construction companies and loans disbursed to companies active in the development of real estate. The denominator comprises gross loans.

Amongst the economies surveyed in the SEACEN region, real estate market indicators are available for Korea, Chinese Taipei and Indonesia. Land prices in Chinese Taipei have risen steadily with the land price index registering an increase of 12 percent from 2005 to 2010. The highest annual increase in the land price index can be seen from 2009 to 2010 registering an increase of 6 percent during this time period. Inflation, on the other hand, decreased from 2 percent in 2005 to a deflationary 1 percent in 2009 and a positive inflation rate of 1 percent in 2010. In response to surging housing prices, the Chinese Taipei authorities adopted a series of macroprudential measures with the aim of urging financial institutions to enhance risk management in order to ensure financial stability.[42] The policy measures reduced the share of residential real estate loans in 2010 to 29.99 percent from the 30.57 percent witnessed a year earlier. In Korea residential real estate prices have risen by a substantial amount with the change in the rate of the residential real estate index increasing from 1.9 percent in 2010 to 6.8 percent in 2011. The steep rise in the residential real estate price index warrants close monitoring especially as real estate related residential and commercial loans account for about one-fifth of total loans granted by banking institutions. In Indonesia, real estate prices have increased by an average of about 3 percent from 2008 to 2011 – below the 6 percent average rate of inflation observed for the period. Exposure of the banking sector to the real estate market is relatively lower than that of Korea and Chinese Taipei with residential and commercial loans accounting only for about 8 per cent and 6 percent of total loans respectively.

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42. See section on macrofinancial linkages for a fuller analysis of macroprudential policy measures for the real estate market for Chinese Taipei.

Chart 20
Residential Real Estate Prices (Percentage Change in Index)

7.3.2 Households

7.3.2.1 Household Debt to GDP

This FSI measures the overall level of indebtedness of the household sector as a share of GDP. High levels of borrowing by the household sector can make them vulnerable to economic and financial shocks lessening their ability to make repayments of interest and principle on borrowed funds to financial institutions. This in turn will impair the balance sheets of financial institutions. Therefore, the soundness of the household sector will have a positive impact on financial institutions. The FSI is calculated by using household debt as the numerator and GDP as the denominator.

7.3.2.2 Household Debt Service and Principal Payments to Income

This FSI measures the capacity of households to cover their debt payments in the form of interest and principle payments. This FSI is calculated by using household debt service payments as the numerator and gross disposable income as the denominator.

Table 7
Household Indicators

Economy	2008	2009	2010	2011
Korea				
Household Debt to GDP	83.9	85.9	85	89.2
Chinese Taipei				
Household Debt to GDP	81.9	84.7	82.1	82.6
Debt Service Payments to Disposable Income	40.72	36.8	36.07	36.4

Source: IMF (Korea) and Project Team Paper (Chinese Taipei).

Amongst the SEACEN economies under scrutiny, the household debt to GDP FSI is only available for Korea and Chinese Taipei. As can be clearly seen from the above data, the household sector constitutes a very important segment of the economy with household debt/GDP ratios hovering above 80 percent for both economies. In the case of Korea, this FSI has risen from 84 percent in 2008 to nearly 90 percent in 2011 registering an increase of 6 percent over the period warranting close monitoring as a deterioration in the health of this sector can have significant adverse impact on financial institution balance sheets. In the case of Chinese Taipei, the high household debt/GDP ratio is reflected in the substantial debt service payments incurred by the household sector. Debt service payments which accounted for about 50 percent of disposable income in 2005 have shown a decelerating trend in the recent past accounting for over one-third of disposable income in 2011. The macroprudential measures taken by the authorities to stem real estate related loans would have favourably impacted the ratio to reduce to lower levels.

8. Macro Financial Linkages – Macroprudential Policy Case Studies

8.1 Sri Lankan Credit Growth

International experience has shown that high rates of growth (above 3 percentage points year-on -year) in the credit to GDP ratios can act as an early warning signal to a financial crisis (IMF Financial Stability Report – GFSR-2011). High credit growth can lead to a worsening of the maturity mismatch position of financial institutions while also resulting in a deterioration in the loan quality through the granting of sub-standard loans. An attempt will be made to examine the risks posed to the time dimension of financial stability by the credit variable for Sri Lanka.

Chart 21
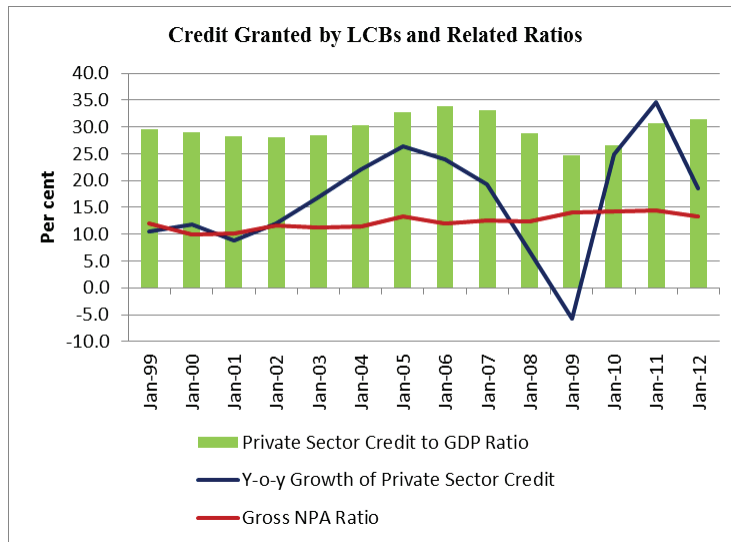
Source: Central Bank of Sri Lanka.

The recent credit growth witnessed in Sri Lanka raised the possibility of systemic risk to the financial sector although this trend reversed during the recent past. Sri Lanka, on average, has recorded about 30 percentage point credit/ GDP ratio during the last decade. However, after a deceleration in credit growth from 2005 to 2009 with the credit/GDP ratio reducing to around 29 percent, credit to the private sector grew by as much as 35 percent in 2011. The high growth in credit was partly the result of policy measures targeted at enhancing the disbursement of credit and loose liquidity conditions. The Central Bank took steps in 2010 and 2011 to reduce general loan provisions from 1 percent to 0.5 percent while temporarily relaxing loan classification requirements to provide credit facilities for borrowers to repay non-performing loans. Moreover, interest rates on housing, credit cards and other loans were reduced to accommodate the demand for credit. Moreover, the cessation of the civil war in 2009 also spurred demand for credit as the northern and northeastern regions resuscitated economically. Furthermore, the economy during the years 2010 and 2011 grew by over 8 percent fuelled by an increase in domestic demand. The conducive macroeconomic environment with low interest rates and inflation, and stable exchange rates spurred demand for credit with credit growth reaching a high of 34 percent in August 2011. The acceleration in credit growth raised the private sector credit to GDP ratio to over 30 per cent again in 2011.

In an environment where credit is expanding at a rapid rate, it is also important to engage in a sectoral decomposition of credit to analyse which sectors are growing rapidly as a consequence of credit disbursements and their implications for financial stability. If credit is being channeled to areas such as the housing sector which can lead to an asset price bubble in the housing market, the bursting of such a bubble can impact financial stability adversely as financial institutions hold a substantial quantum of collateral in the form of real estate. Such an analysis for Sri Lanka does not show the build-up of a credit bubble impinging adversely on financial stability. Charts 22 and 23 show that credit growth has not created any asset bubbles with the sectoral composition of private sector credit extended by commercial banks remaining more or less similar during 2009 and 2012.

Chart 22
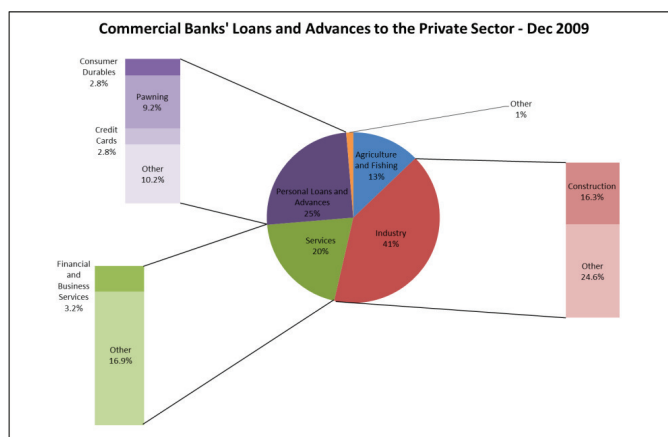
Chart 23

Source: Central Bank of Sri Lanka.

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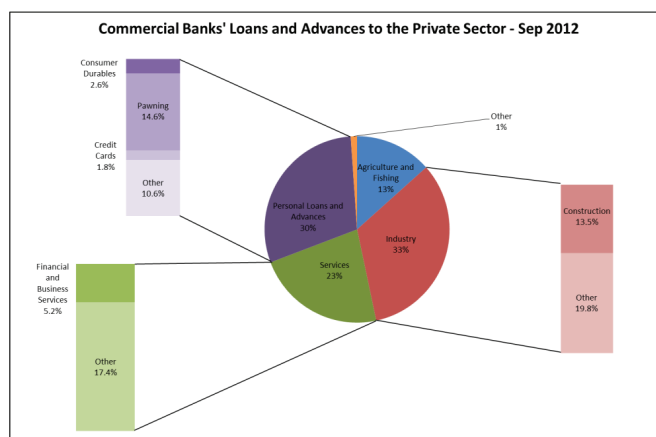
High credit growth also resulted in an expanded trade and current account deficit with demand for imports sustained at high levels, threatening the country's macroeconomic stability. Increased lending by commercial banks also contributed to the growth of broad money which grew at a rapid pace into early 2012, with growth rates of 23 percent in April 2012 exceeding the forecast of 18 percent envisaged for the year. These developments warranted policy action in the macroeconomic front to mitigate inflationary pressures arising from excessive credit and monetary expansion and contain the current account deficit of the balance of payments.

An examination of other macro-financial indicators can also shed some light on credit growth and its impact on financial stability. Chart 24 shows the some of the macro-financial linkages in the Sri Lankan economy. The All Share Price Index of the stock market shows an accelerating trend from 2009 to early 2011 reaping the benefits of the peace dividend with the ending of the ethnic conflict in 2009. In 2010, the Sri Lankan Stock Market was recognised as the second best performing stock market in the world. However, thereafter a sharp decline in prices is witnessed although credit growth at this time was still on the rise nearing a peak of 35 percent year-on-year. Similarly, land price indices do not show the formation of a bubble during the period of rapid credit growth although there is a rise in land prices which, however, is below the inflation rate. [43]

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43. Land price indices, which are compiled by the Central Bank of Sri Lanka, are at a formative stage of development and hence not published. Permission to use these indicators should be sought by the Central Bank of Sri Lanka.

Chart 24
Macro-Financial Linkages

All Share Price Index

Chart 1: Index for residential lands (1998=100)

Chart 2 : Index for commercial lands (1998=100)
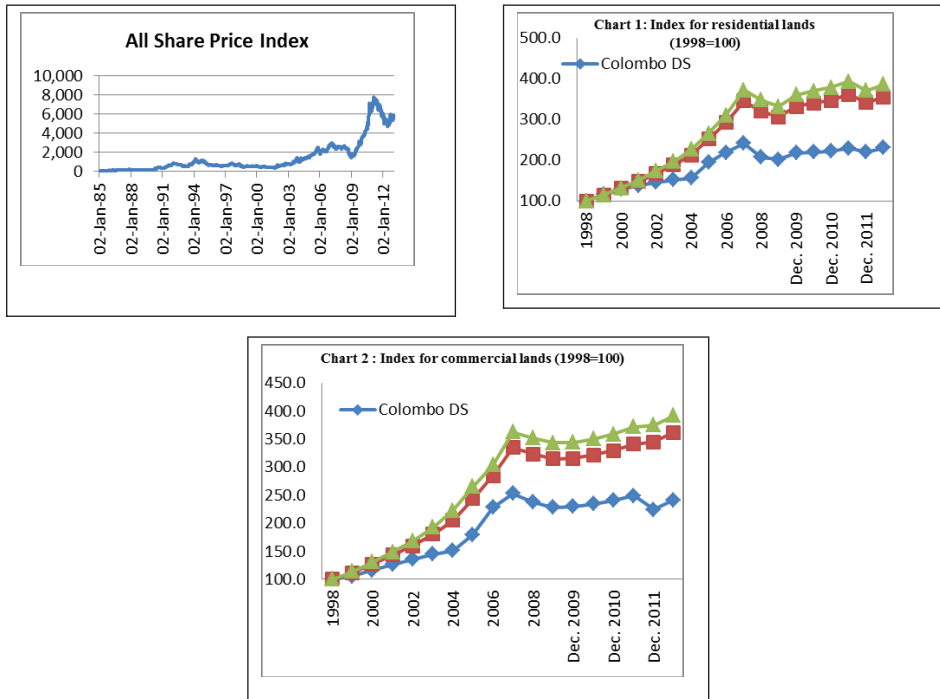
Source: Central Bank of Sri Lanka.

In response to the emerging macroeconomic imbalances, the Sri Lankan authorities utilised a macroprudential tool – a credit ceiling (quantitative cap on credit growth) – to reduce the pace of growth in private sector credit by limiting the growth of commercial bank rupee credit to 18 percent or 23 percent of the outstanding rupee credit as at end 2011, with the latter restriction applying to credit funded through overseas borrowings. Although the policy measure in itself was macroprudential in nature, the intended purpose was largely to stifle the emerging macroeconomic imbalances. Apart from the macroprudential measure, the Central Bank took monetary policy measures to increase the Repurchase rate and the Reverse Repurchase rate on two occasions in February 2012 and April 2012 while enhancing the flexibility of the exchange rate to reflect market pressures.[44] The credit ceiling and the contractionary monetary policy

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44. The Central Bank raised the repurchase rate and the reverse repurchase rate by 50 basis points each in February 2012, while in April 2012 the repurchase rate was increased again by 25 basis points and the reverse repurchase rate by 75 basis points.

measures resulted in a gradual decline in credit growth from April 2012. Private sector credit growth decelerated to 23 percent in October 2012 thereafter declining again to 17 percent in December, 2012. Thus, the imposition of the credit ceiling coupled with monetary policy measures managed to rein in credit growth averting possible inflationary pressures and strengthening the stability of the financial system at the same time. With the credit/GDP ratio in 2012 reverting back to Sri Lanka's average of 30 percent, coupled with the fact that there was no evidence of asset price bubbles as shown by the stock market and housing price indices, Sri Lanka's episode of rapid credit growth in the recent past can be viewed as a return to normalcy from a depressed credit situation. However, it is important to monitor non-performing loans as defaults may appear in the future as it takes time for these vulnerabilities to appear.

8.2 Chinese Taipei – Macroprudential Policies for the Housing Market

Chinese Taipei experienced surging house prices and a concentration of estate related loans by financial institutions since end of 2009. The housing price index rose by 6 percent from 100.38 in 2009 to 105.63 in 2011. Inflation at a negative 1 percent in 2009 increased to 1 percent in 2011. The exposure of financial institutions to real estate prices was substantial with real estate related loans for residential and commercial purposes comprising over 40 percent of the total credit. In order to mitigate the adverse impact of these developments on financial institutions, Central Bank, Chinese Taipei (CBC) in June 2010, adopted macroprudential measures which capped the loan-to-value (LTV) ratio on second (or more) housing loans for home purchases in specified districts while discontinuing with the grace period for such loans (Central Bank of the Republic of China, 2012). In December 2010, the CBC extended the coverage of specific areas and lowered the maximum LTV ratio, as well as tightening underwriting standards for real estate loans. These measures brought about a reduction in the share of real estate related loans of financial institutions from around 38 percent in June 2010 to 36 percent in February 2012. Furthermore, the LTV ratio of real estate-related loans dropped significantly from an average of 64 percent in July 2010 to 58 percent in March 2012 in respect of housing loans.

8.3 Cambodia – Dollarisation and Financial Stability

Cambodia's financial sector is at a rudimentary stage of development with the National Bank of Cambodia (NBC) established as the Central Bank in early 1980s. There is limited financial intermediation and low public confidence in the domestic value of money and the domestic banking system. The Cambodian

economy has two parallel bases; the dollar based urban economy which thrives on foreign currency inflows from garment exports, tourism receipts, foreign direct investment and aid and the riel based rural economy which is largely agricultural. In the rural areas, banking services are scarce with the microfinance operations of NGOs constituting the de facto providers of credit. In the urban sector, most transactions are carried in dollars while the NBC carries on its transactions in the domestic currency. Moreover, commercial banks transact in dollar terms with credit to the private sector denominated in foreign currency. The dollarisation, which can be measured as a ratio of foreign currency deposits to broad money, has increased from around 60 percent in the late 1990s to about 80 percent recently. Although Riel deposits have also grown significantly, such deposits as a percentage of GDP amount to only about 1 percent. Cambodia has no money, capital and interbank markets.

High dollarisation can severely hamper the effectiveness of monetary policy as the central bank operations in Riels have almost no impact on overall monetary developments. The central bank cannot directly influence the foreign currency component of broad money as foreign currency is in the hands of private sector agents. Therefore, money supply is determined not by the monetary authorities but by the behaviour of private sector agents who hold both foreign and domestic currency denominated assets. In such circumstances, the money supply becomes endogenous and the authorities find difficulty in fighting inflation by adjusting the domestic money supply. Nevertheless, the NBC has reserve requirements for both foreign currency deposits and Riel deposits to control base money. However, as financial intermediation is limited and it is conducted almost entirely in foreign currency, the NBC's ability to control base money is also limited. In the wake of the 2009 global crisis, when the NBC lowered the required reserves ratio (RRR) to boost economic activity by providing liquidity to banks, the quantum of excess reserves at the NBC was the highest and private sector credit witnessed a reduction. Moreover, as the NBC does not act as lender of last resort, it does not influence interest rates and cannot use the interest rate as an effective instrument of monetary policy. Moreover, dollarisation also incurs a loss in terms of seignoirage as this accrues to the USA.[45] Exchange rate policy also is ineffective as high dollarisation prevents the full adjustment of the economy to the change in the exchange rate. As most transactions are in dollars, an exchange rate adjustment reflecting the changed value of the local currency will not have the desired effect on aggregate demand in the economy. In such circumstances, fiscal policy takes a leading role in stabilising the economy.

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45. See Zamaroczy and Sa (2002) and Duma (2011) for literature on seignoirage in Cambodia.

The combination of such a macroeconomic policy matrix brings forth its own risks to financial stability. Since the Central Bank does not act as a lender of last resort, sudden loss of confidence in the banking system can lead to a deposit run which could compromise the NBC's international reserves (Duma, 2011). Indirect credit risk resulting from a devaluation of the Riel can also be more prominent in the context of substantial dollar lending to non-hedged borrowers. As lending to microfinance institutions is required to be in Riel, financial entities are subject to exchange rate risk in such instances. However, as the microfinance loan share (11 percent) is much lower than that of commercial banks (89 percent), this risk is not very crucial at present (Youraden, 2011).[46] High dollarisation also requires NBC to maintain an adequate level of dollar liquidity both at the macro level and at the individual financial institution level (Duma, 2011). Dollarisation adds to banking sector vulnerabilities arising from currency mismatches, exchange rate and credit risks and dollar non-performing loans (Unteroberdoerster, 2002).

Solutions to this include moving towards risk based supervision to help monitor risks taken by banks in extending credit (Duma, 2011). A strict control on risks related to foreign currency loans should be maintained on banks to reduce instability in the financial system. This should also be supported by risk disclosures to borrowers (Kokenyne et al, 2010).

9.   Concluding Remarks

The issue of financial stability has emerged at the top of the agenda of central banks in the wake of the financial crisis of 2007. The focus on stability has emphasized the role of stability indicators in the measurement of financial risk. This paper has examined the use of financial stability indicators in the SEACEN economies of Korea, Chinese Taipei, Indonesia, Sri Lanka, Nepal and Cambodia in the context of macroprudential policy. The assessment and review of financial stability indicators is conducted through a comparison of Financial Soundness Indicators (FSIs) of the IMF as FSIs constitute a uniform set of indicators that can be compared across countries.   While the economies surveyed are at different stages of development in terms of the depth of the financial sector, the availability of indicators for financial risk assessment also range from the basic indicators in economies such as Nepal to more sophisticated indicators in countries such as Korea and Chinese Taipei. Korea appears to have the most comprehensive coverage of FSIs with 12 core and 15 encouraged

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46. As at December, 2009 commercial bank loan share was 89 percent while the microfinance institutions made up the balance 11 percent.

indicators compiled for the banking and other sectors of the economy and disseminated through the IMF FSI website. The FSIs for Chinese Taipei, which are compiled in accordance to the IMF methodology, include those for deposit takers as well as households and markets. In the case of Indonesia, FSIs cover the banking sector and are compiled in accordance to the IMF methodology while being published in the IMF website for financial soundness indicators. Sri Lankan FSIs for deposit takers are compiled separately for the banking and the non-bank sectors and published in the Financial Stability Reports of the Central Bank of Sri Lanka. The few FSIs available for Nepal and Cambodia cover the banking sector and are not disseminated through a publication or website.

A comparison of Financial Stability Reports (FSRs) of the economies under survey are also vastly different in terms of quality and information provided. While Sri Lanka, Indonesia, Chinese Taipei and Korea have FSR publications, Cambodia and Nepal are two economies in the SEACEN region that do not have such publications. Moreover, the economies surveyed also vary with regard to the extent to which the FSR is analytical in comparison to purely descriptive. Thus, there is a need to standardise FSRs where they are published at present and bring in new FSR publications for those economies that do not compile these reports at present. Moreover, Cambodia and Nepal also do not have a department or authority in the Central Bank or elsewhere, dedicated to the assessment of financial stability. As the financial sectors of these economies grow, the establishment of units dedicated to the assessment of financial stability in terms of macroprudential policy is essential. As economies in the SEACEN region are rapidly growing while increasingly integrating with the global economy, financial risk assessment in the SEACEN region needs to improve with all economies making use of the macroprudential policy toolkit for financial stability assessment. The improvement of financial stability analysis would require capacity building in some of the SEACEN economies under review. Technical assistance in this respect can perhaps be provided by more advanced countries such as Korea in the SEACEN region.

The assessment of core FSIs for the SEACEN economies under review generally show the maintenance of required standards in terms of these indicators. Profitability ratios in terms of ROA and ROE indicators for the SEACEN economies under review show positive ratios reflecting the generation of profits out of banking sector assets and equity. Profitability indicators also move in tandem to economic conditions with most economies showing improved profitability for the banking sector during the years 2010 and 2011 in particular, reflecting better economic conditions in comparison to generally lower ROA indicators seen during the economic downturn experienced in 2008 and 2009. The FSI interest margin to gross income, which measures the relative share of

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net interest earnings in comparison to gross income, has high numerical values corroborating the evidence shown by the profitability ratios. The FSI non-interest expenses to gross income for the SEACEN economies under review shows high values except for Sri Lanka which has a lower value reflecting the importance of interest and non-income interest for the banking sector in Sri Lanka.

Capital adequacy indicators reveal that the banking sectors of these economies are well capitalised. The regulatory capital to risk weighted assets FSI shows most countries, with the exception of Nepal for 2008 and 2009, meeting the minimum 8 percent capital adequacy requirement. An analysis of core capital strength for the banking sectors of Korea, Indonesia and Sri Lanka reveal high Tier 1 capital components well above 50 percent in the banking sectors with capital buffers strengthening over time.

Asset based FSIs such as non-performing loans to gross loans remain below 5 percent for most of the SEACEN economies under review. While the higher income economies in the region such as Chinese Taipei and Korea have very low NPL ratios below 1 percent, countries such as Sri Lanka and Nepal carry higher ratios of around 6 percent for the period under study. Meanwhile, Cambodia and Indonesia have NPL ratios below 4 percent in general. With regard to sectoral distribution of loans, it is noted that enhanced exposure to collateral in the form of gold and property can have adverse repercussions on financial system stability.

Liquidity indicators of the SEACEN economies under review are in accordance to required standards reflecting the importance given to liquidity management in the risk management process. Adequate liquidity buffers have been maintained as shown by the Liquid Asset ratios of the SEACEN economies surveyed. The liquid asset ratios range from about an average of 36 percent for Korea to 12 percent in Chinese Taipei. Similarly, the liquid assets to short term liabilities ratios for the banking sectors of Korea, Chinese Taipei, Indonesia and Cambodia range from 15.7 percent in Chinese Taipei to 109 percent in Korea.

As financial institutions are increasingly diversifying away from their traditional intermediation function towards market making and trading activities, market risk can have a significant impact on the assets and liabilities of financial institutions. In the case of currency risk, the FSI net open position in foreign exchange to capital can be used to examine the exposure to foreign exchange risk. This indicator for the SEACEN economies under review appears to be available for only five economies – Chinese Taipei, Korea, Indonesia, Sri Lanka

and Cambodia. All economies except Sri Lanka show positive open positions in terms of this indicator for the period 2009 to 2011.

A few SEACEN economies under review compile encouraged financial soundness indicators in accordance to the IMF methodology. Encouraged FSIs in such format are compiled and disseminated by Korea, Indonesia and the Chinese Taipei. Available financial soundness indicators that monitor the real estate sector include real estate price indices and real estate loans to residential and commercial sectors. Amongst the economies surveyed in the SEACEN region, real estate market indicators are available for Korea, Chinese Taipei and Indonesia. While land prices in Chinese Taipei have risen by about 12 percent from 2005 to 2010, in Korea the residential real estate index has risen by about 6.8 percent in 2011. The steep rise in the residential real estate price index warrants close monitoring especially as real estate related residential and commercial loans account for about one-fifth of total loans granted by banking institutions. In the case of Chinese Taipei, macroprudential measures introduced reduced the share of residential real estate loans in 2010 to 29.99 percent from the 30.57 percent witnessed a year earlier. In Indonesia, real estate prices have increased by an average of about 3 percent from 2008 to 2011 – below the 6 percent average rate of inflation observed for the period. However, the exposure of the banking sector to the real estate market is relatively lower than that of Korea and Chinese Taipei with residential and commercial loans accounting only for about 8 per cent and 6 percent of total loans respectively.

Encouraged FSIs that monitor the household sector constitute the household debt to GDP indicator and the household debt service and principal payments to income FSI. Amongst the SEACEN economies under scrutiny, the household debt to GDP FSI is only available for Korea and Chinese Taipei. The household sector constitutes a very important segment of the economy for both countries with household debt/GDP ratios hovering above 80 percent. The household debt service and principal payments to income FSI, which is only available for Chinese Taipei, reflects the substantial debt service payments incurred by the household sector. Debt service payments show a decelerating trend in the recent past accounting from about half of disposable income in 2005 to about one-third of disposable income in 2011. The macroprudential measures taken by the authorities to stem real estate related loans would have favourably impacted the ratio to reduce to lower levels. Data on the household sector needs to be developed for economies such as Sri Lanka, Nepal and Cambodia as households constitute an important segment of the economy where risk assessment is needed for financial stability purposes.

Lessons learnt from the recent financial turmoil highlight the need for a macroprudential orientation to prudential regulation and supervision with the regulatory authorities expanding their horizons to include a macro or systemic perspective to regulation and supervision**.** It is important to complement microprudential supervision as practiced at present with macroprudential supervision that can address the risks arising from the procyclicality of the financial system and the systemic risk resulting from interconnectedness of financial entities in the financial system. Although the two approaches share some common tools such as liquidity requirements, minimum capital standards and loan provisioning requirements in assessing financial stability, the authorities responsible for stability should adopt a macroprudential perspective by assessing risks for the financial system as a whole with a "top-down" approach. Although the objective of micro-prudential supervision is to limit the likelihood of the failure of individual institutions, or to reduce "idiosyncratic risk" which in turn is intended to reduce the risk of the whole financial system, it does not capture the common exposures of the financial system. In contrast, macro-prudential supervision aims to limit the costs to the economy resulting from financial distress arising from systemic risks. In the case of time dimension risks, authorities should closely monitor the health of the economy paying particular attention to macroeconomic variables that can destabilise the financial system over time. In the case of the cross section dimension, authorities should concentrate on risks arising from interlinkages of financial institutions paying particular attention to systemically important banks in the financial system. Co-ordination between different regulators who are responsible for different components of the financial system is essential in order to monitor risks arising from the interconnectedness of diverse institutions in the financial system. Moreover, the imposition of microprudential requirements from a macroprudential perspective on indicators such as capital and liquidity ratios in accordance to the systemic importance of financial institutions constitutes an important way forward in terms of macroprudential policy for these SEACEN economies.

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Financial Soundness Indicators

CORE INDICATORS	Year	Cambodia	Indonesia	Korea	Nepal	Sri Lanka	Chinese Taipei
Capital Adequacy							
Regulatory capital to	2008	27.6	17.5	12.3	4	14.5	11
risk-weighted assets	2009	32.3	17.8	14.4	7.2	16.1	11.8
	2010	31.4	16.2	14.3	9.6	16.2	12
	2011	26.2	16.1	14	10.6	16	12.1
Regulatory tier I capital to	2008	27.7	15.4	8.8	1.8	12.5	8.4
risk-weighted assets	2009	33	16.0	10.9	5.2	14.1	9
	2010	32.6	15.1	11.3	7.9	14.3	9.2
	2011	26.3	14.7	10.7	9.1	14.3	9.1
Asset Quality							
Non-performing Loans to	2008	2.9	3.2	0.6	6.1	6.3	1.5
Gross Loans	2009	3.9	3.3	0.6	3.6	8.5	1.2
	2010	2.9	2.5	0.6	2.5	5.4	0.6
	2011	2.1	2.1	0.5	3.2	3.8	0.4
Earnings and Profitability							
Return on assets	2008	2.7	2.4	0.7	2.2	1.9	0.1
	2009	0.9	2.6	0.6	2.4	1.8	0.3
	2010	1.2	2.7	0.7	2.1	2.7	0.6
	2011	1.7	2.3	1	1.9	2.4	0.6
Return on equity	2008	14	25.3	9.9	143.6	13.4	1.9
	2009	4.3	26.8	7.8	81.3	11.8	4.5
	2010	6.1	25.9	9.7	51.8	22.2	9.1
	2011	8.3	20.3	13.2	41.1	20	9.27
Interest Margin to	2008	48.3	63.6	66.3	-	28.9	78.5
Gross Income	2009	60.8	62.5	71.1	-	30.8	59.5
	2010	62.2	60.5	70.9	-	37.7	59.5
	2011	64.3	59.8	68.8	-	39.5	62.6
Non-interest Expenses to	2008	64.2	48.7	60.2	-	22.3	63.0
Gross Income	2009	64.2	47.1	55.3	-	22.8	59.8
	2010	63.2	49.2	52.1	-	26.5	56.0
	2011	57.5	49	52.8	-	27.9	55.4

CORE INDICATORS	Year	Cambodia	Indonesia	Korea	Nepal	Sri Lanka	Chinese Taipei
Liquidity							
Liquid Asset Ratio	2008	14.16	25.9	35.3	12.9	28.3	12.7
	2009	19.4	28.7	37.8	15.8	35.3	15.2
	2010	18	27.2	35.2	13.6	31.4	10.5
	2011	16.2	26.2	35.4	23.9	26.9	11.1
Liquid Assets to	2008	30.6	30.8	101.4	-	-	18.4
Short Term Liabilities	2009	26.8	33.9	103.9	-	-	21.0
	2010	25.2	32.1	117.5	-	-	14.7
	2011	23	31.2	109.3	-	-	15.7
Sensitivity to Market Risk							
Net Open Position in	2008	0.9	9.2	19.6	-	2.2	2.4
Foreign Exchange to Capital	2009	1.3	3.3	2.9	-	-1.3	2.4
	2010	2	2.9	0.9	-	-1.12	2.7
	2011	3.4	3.1	0.9	-	-1.6	-
ENCOURAGED INDICATORS							
Households							
Household borrowing/GDP	2008	-	-	83.9	-	-	81.9
	2009	-	-	85.9	-	-	84.7
	2010	-	-	85	-	-	82.1
	2011	-	-	89.2	-	-	82.6
Debt service Payments to	2008	-	-	-	-	-	40.7
Disposable income	2009	-	-	-	-	-	36.8
	2010	-	-	-	-	-	36.1
	2011	-	-	-	-	-	36.4
Market Liquidity							
TWSE turnover ratio	2008	-	-	-	-	-	145.5
	2009	-	-	-	-	-	178.3
	2010	-	-	-	-	-	136.7
	2011	-	-	-	-	-	
Average turnover ratio in	2008	-	-	-	-	-	47.9
bond market	2009	-	-	-	-	-	31.6
	2010	-	-	-	-	-	32.4
	2011	-	-	-	-	-	

ENCOURAGED INDICATORS	Year	Cambodia	Indonesia	Korea	Nepal	Sri Lanka	Chinese Taipei
Real Estate Market							
Residential real estate	2008	-	-	-	-	-	29.2
loans to total loans	2009	-	-	-	-	-	30.6
	2010	-	-	-	-	-	30.0
	2011	-	-	-	-	-	
Commercial real estate	2008	-	-	-	-	-	12.1
loans to total loans	2009	-	-	-	-	-	12.5
	2010	-	-	-	-	-	13.3
	2011	-	-	-	-	-	

Source: IMF (Korea, Indonesia), Central Bank of Sri Lanka and project team papers (Chinese Taipei, Cambodia, Nepal)

Chapter 2

STRENGTHENING FINANCIAL STABILITY INDICATORS IN THE MIDST OF RAPID FINANCIAL INNOVATION: UPDATES AND ASSESSMENT IN CAMBODIA

By
May Sokchetha[1]

1. Introduction

Over the past two decades, Financial Stability has become a major concern in the international forums and an increasingly "hot topic" for international cooperation. Intuitively, people have a vague understanding of what financial stability is, namely the opposite of financial instability, which could be viewed as a major disruption or combination of disruptions impacting negatively on the performance of the overall financial system. Definitions of "financial stability" are numerous, and few definitions are comprehensive enough to provide a clear picture of "financial stability" or where and when "financial instability" actually starts. In addition, definitions also tend to change with each crisis – sometimes by stressing the symptoms, developments or causes of the last major crisis. The recent global crisis (starting with the "subprime" crisis in the United States in mid-2007) also introduced new terminologies, concepts, advisory boards and concepts.

Around twenty five years ago in the developed countries, financial stability mainly concerned the banking and the payments systems – under the responsibilities of the central banks. However today, financial stability extends to a far broader domain encompassing the overall financial sector including banks, financial market and insurance sectors, which are deemed to have contributed to the recent global crisis. Moreover, the Final Communiqué of the G20 Summit in London (April 2009) extends the domain still further to include international trade and capital flows.

Financial stability can no more be considered as a priority that can be managed domestically by each country's central bank and fiscal authority. In this perspective, the gravity and the width of the recent financial crisis

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demonstrated the need for cooperation at an international level. The crisis, also clearly highlighted the need for preparedness and anticipation as well as international cooperation for crisis management.

The financial system in Cambodia is at a rudimentary stage of development. Almost three decades of domestic conflict nearly completely destroyed the basic economic and social infrastructure of Cambodia, including its financial system. Cambodia regressed to a barter economy and public knowledge about the role of financial institutions was almost erased. After the economy went through a slow and painful process of rehabilitation, the role of the financial sector was progressively restored as financial institutions regained public confidence.

Despite this progress, the structure of the financial system in Cambodia remains traditional. Banks are dominant. The insurance industry plays a very small role. The money and capital markets are non-existent.

2. Structure of the Financial System in Cambodia

The financial system in Cambodia is still at the very early stage of development. Monetization on the economy has been re-established gradually since the re-creation of the National Bank of Cambodia (NBC) as the country's central bank in the early 1980s. However, a subsistence economy still prevails in the rural and remote areas, while transactions based on cash are widespread in the economy. The financial system represented largely by the banking institutions and banking products are still very limited. Under this circumstance, the NBC tracks only two monetary aggregates, M1 and M2, which correspond to two definitions of money supply, narrow money and broad money, respectively[2].

The National Bank of Cambodia is an autonomous public entity. The Central Bank is a legal entity with full jurisdiction and have the capacity to lend, borrow and enter into all other contracts, institute legal proceedings and be subject to such proceedings and for the purpose of its business, acquire, hold, and dispose of property whether movable or immovable. The principle mission of the Central Bank is to determine and direct monetary policy aimed at maintaining price stability to facilitate economic development within the framework of the Kingdom's economic and financial policy.

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2. The monetary aggregates are compiled base on the liquidity of financial instruments, consistent with the manual on monetary and financial statistics, which is a descriptive and advisory guidebook by the International Monetary Fund.

The banking sector in Cambodia consists of commercial banks, specialised banks, and micro-finance institutions. The Law on Banking and Financial Institution of the Kingdom of Cambodia defines banking operation as: (1) credit operations for valuable consideration, including leasing, guarantees and commitments under signature; (2) the collection of non-earmarked deposits from the public; and (3) provision of means of payment to customers and the processing of the said means of payment in national currency or foreign exchange. Any institution carrying out all these three activities is deemed to be engaged in banking activities and recognised as a commercial bank. Institutions which carry out only one of these three basic activities are categorised as specialised banks. In practice, specialised banks are only involved in lending activities. Microfinance Institutions (MFIs) also engage in banking activities through the soliciting of deposits and the granting of credits, but their scope of operation is limited within certain thresholds to distinguish the markets of banking and micro-finance.

Domestic and foreign banks increased from 35 in 2011 to 39 in September 2012, consisting of 32 commercial banks[3], 7 specialised banks (including one state owned banks). In addition, there are 32 licensed microfinance institutions where 7 are eligible to collect customer deposits, and 31 registered microfinance institutions in the Cambodian banking system.

The size and scale of operation for each institution vary significantly. Based on assets, banks can be categorised as large (4), medium (5), small (20) and specialised (6). In terms of ownership, the banking sector comprises foreign branches (7), foreign subsidiaries (8) and foreign majority interest (8), local (6) and specialised (6)[4]. There are no separate regulations for branches of foreign banks operating in Cambodia. According to current provisions of the financial institution law and subsequent regulations, rules applicable to foreign banks, especially prudential rules, are the same as those applicable to local incorporated banks

3. Literature Survey on Financial Instability/Indicators

Shinasi (2004) defines financial stability as the following - "A financial system is in the range of stability whenever it is capable of facilitating (rather than impeding) the performance of an economy, and of dissipating financial

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3. 32 commercial banks include 12 local incorporated banks, 11 subsidiaries, and 9 foreign bank branches.

4. According to the banking law, banking and financial institutions may be locally incorporated in Cambodia or be a branch of a foreign bank.

imbalances that arise endogenously or as a result of significant adverse and unanticipated event". He adds further that "financial stability is a condition in which an economy's mechanism for pricing , allocating and managing financial risk (credit, liquidity, counterparty, market, etc.) are functioning well enough to contribute to the performance of the economy".

Duisenberg, the first president of the European Central Bank, compared the elusive concept of financial stability to the more concrete definition of monetary stability as follows - "monetary stability is defined as stability in the general prices, or as absence of inflation or deflation. Financial stability does not have a universally accepted definition. Nevertheless, there seems to be a broad consensus that financial stability refer to smooth function of the key elements that make up the financial system".

4. Specification of Macro-prudential Indicators

The objective of macro-prudential regulation is to reduce the probability of distress for the entire financial system. The source of distress incorporates a host of potential channels, including interdependence and linkages among financial institutions through clearing and settlement systems, and common exposures to market and credit risks.

Macro-prudential policies may be most successful in the presence of an overall policy framework that fosters complementary management of monetary and macro-prudential policies. For example, incentives to circumvent countercyclical regulations may prove too strong when accommodative monetary policy fuels the demand for credit. As such, NBC may need to critically rethink the role of monetary policy in contributing to the success of financial stability policies, not just by softening the impact of the unwinding of financial imbalances, but also by containing the build-up of these imbalances. In addition, it is imperative to recognise the need to balance the objective to counter financial excesses with a need for a dynamic financial sector, capable of supporting economic growth.

While there are advantages of designing policy rules upfront, such as reducing supervisory discretion and introducing pre-commitment, these rules may have their limitations and may entail periodic updating in order to avoid the risk that they be arbitraged, and more generally to ensure that they keep pace with developments in the financial sector.

4.1 Financial Stability Indicators

To strengthen the banking system, the banking law required implementation of a bank re-licensing programme based on new level of minimum capital requirement and banks' compliance with relevant laws and regulations. According to the banking law, banking and financial institutions may be locally incorporated in Cambodia or be a branch of a foreign bank. There are no separate regulations for branches of foreign banks operating in Cambodia. According to current provisions of the financial institutions law and subsequent regulations, rules applicable to foreign banks, especially prudential rules are the same as those applicable to locally incorporated banks.

Figure1
Cambodia Financial Indicators

	Q1 2006	Q2	Q3	Q4	2006	Q1 2007	Q2	Q3	Q4	2007	Q1 2008	Q2	Q3	Q4	2008	Q1 2009	Q2	Q3	Q4	2009	Q1 2010	Q2	Q3	Q4	2010	Q1 2011	Q2	Q3	Q4	2011	Q1 2012
Capital Adequacy																															
Regulatory capital to risk-weighted assets (%)	34.7	30.0	28.3	25.8	25.8	26.6	26.8	24.8	23.6	23.6	24.2	25.6	25.5	27.6	27.6	32.4	33.1	34.2	32.3	32.3	31.5	31.3	31.5	31.4	31.4	31.2	29.0	27.5	26.2	26.2	29.1
Regulatory Tier 1 capital to risk-weighted assets(%)	35.2	30.2	28.4	26.8	26.8	27.3	27.5	26.6	24.6	24.6	25.1	26.2	25.9	27.7	27.7	32.8	37.2	34.8	33.0	33.0	32.6	32.7	33.3	32.6	32.6	32.1	29.5	27.7	26.3	26.3	29.3
Nonperforming loans net of provisions to capital (%)	5.5	3.5	2.7	9.1	9.1	9.1	9.0	6.1	2.9	2.9	3.5	3.2	4.6	5.9	5.9	7.9	7.7	9.1	4.7	4.7	4.8	5.0	5.3	3.4	3.4	3.6	4.2	4.7	2.8	2.8	3.7
Net open position in foreign exchange to capital (%)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.9	0.9	0.9	4.2	1.3		1.3	2.9	4.6	4.4	2.0	2.0	2.9	2.7	3.4	3.4	3.4	2.8
Asset Quality																															
Nonperforming loans to total gross loans (%)	5.6	4.2	3.5	6.0	6.0	6.0	5.4	5.0	3.6	2.0	2.0	2.0	2.3	2.9	2.9	4.3	4.9	5.7	3.9	3.9	4.1	4.2	4.2	2.9	2.9	3.0	3.0	2.1		2.1	2.4
Sectoral distribution of loans to total gross loans																															
Residents (%)	83.4	81.1	80.7	83.0	83.0	81.7	82.5	81.6	81.1	81.1	90.7	94.6	91.8	94.4	94.4	95.1	97.8	94.7	95.0	95.0	91.7	92.1	91.8	91.8	91.8	91.0	90.8	91.1	92.3	92.3	88.3
Deposit-takers (%)	1.2	0.9	1.4	1.2	1.2	1.2	2.2	1.7	1.5	1.5	1.8	1.7	3.2	3.8	3.8	3.5	4.5	5.9	6.5	6.5	6.6	6.1	4.0	4.4	4.4	3.9	4.7	4.9	7.7	7.7	8.1
Central bank (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other financial corporations (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
General government (%)	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nonfinancial corporations (%)	76.6	72.7	71.8	72.9	72.9	70.5	68.7	66.5	64.0	64.0	71.2	74.2	69.6	70.6	70.6	72.4	74.4	71.3	71.1	71.1	68.9	69.2	72.4	72.3	72.3	72.2	71.3	71.1	69.5	69.5	65.8
Other domestic sectors (%)	5.4	7.3	7.4	8.6	8.6	9.8	11.5	13.3	15.6	15.6	17.7	18.8	19.0	20.1	20.1	19.3	18.9	17.5	17.5	17.5	16.2	16.8	15.4	15.1	15.1	14.9	14.8	15.1	15.1	15.1	14.4
Nonresidents (%)	16.6	18.9	19.3	17.0	17.0	18.3	17.5	18.4	18.9	18.9	9.3	5.4	8.2	5.6	5.6	4.9	2.2	5.3	5.0	5.0	8.3	7.9	8.2	8.2	8.2	9.0	9.2	8.9	7.7	7.7	11.7
Earning and Profitability																															
Return on assets (%)	3.6	3.2	1.8	2.5	2.5	3.3	3.1	1.6	2.6	2.6	3.9	3.3	1.7	2.8	2.8	1.3	1.1	0.6	1.0	1.0	1.2	1.2	0.7	1.3	1.3	1.9	1.8	1.1	1.7	1.7	2.3
Return on equity (%)	16.5	14.7	8.6	12.1	12.1	17.4	17.2	9.4	15.8	15.8	22.2	17.1	8.8	13.0	13.0	5.8	5.1	2.5	4.5	4.5	5.6	5.7	3.4	5.8	5.8	8.6	8.7	5.2	8.3	8.3	11.0
Interest margin to gross income (%)	62.4	65.9	58.1	59.1	59.1	56.7	16.9	17.7	12.6	12.6	24.1	37.0	44.4	48.3	48.3	67.0	66.4	64.1	60.8	60.8	68.9	67.8	67.9	62.2	62.2	67.7	65.3	63.6	64.3	64.3	63.1
Noninterest expenses to gross income (%)	50.1	49.0	51.6	51.2	51.2	49.9	86.0	82.7	88.3	88.3	78.6	70.2	65.5	64.2	64.2	65.4	66.9	65.4	64.2	64.2	65.3	62.9	61.2	63.2	63.2	56.8	57.9	56.1	57.5	57.5	53.9
Liquidity																															
Liquid assets to total assets (%)	24.4	23.0	21.6	21.6	21.6	21.7	24.8	21.2	18.1	18.1	16.5	16.4	13.2	14.2	14.2	15.4	16.2	19.8	19.4	19.4	16.1	18.0	17.6	18.0	18.0	17.9	17.9	19.0	16.2	16.2	17.2
Liquid assets to short-term liabilities (%)	33.3	30.9	28.7	28.7	28.7	28.3	32.0	27.0	22.7	22.7	21.0	21.3	17.2	19.1	19.1	20.8	22.4	27.3	26.8	26.8	22.4	24.8	24.5	25.2	25.2	25.2	25.3	27.0	23.0	23.0	24.3
Sensitivity to market																															
Net open position in foreign exchange to capital (%)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.9	0.9	0.9	4.2	1.3		1.3	2.9	4.6	4.4	2.0	2.0	2.9	2.7	3.4	3.4	3.4	2.8
Encouraged set																															
Deposit takers																															
Capital to assets (%)	21.7	21.5	21	20.2	20.2	19	18	17	16.7	16.7	17.5	19	18.9	21.5	21.5	21.6	22.1	22	22.2	22.2	21.2	21	21.4	22.3	22.3	21.8	20.9	21	21	20.9	20.5
Large exposures to capital (%)	0.5	1.0	0.7	1.0	1.0	1.3	1.2	2.1	1.0	1.0	1.9	1.5	1.6	1.5	1.5	1.6	1.5	1.6	1.2	1.2	1.1	1.6	1.8	1.5	1.5	1.1	1.5	1.6	1.2	1.2	1.2

Source: National Bank of Cambodia

4.1.1 Banking Sector Performance

For the above mentioned period, bank credits rose 30.6% (y-o-y) since banks mostly focus on lending to the agricultural, real estate, manufacturing, and trade sector. In addition, bank deposits grew at 21.7% (y-o-y) owing to the higher competition in the banking sector with higher deposit rates, growing public confidence in the banking system and bank operation expansion to rural areas. It should be noted that the major banks dominate the Cambodian banking system.

Figure 2
Credit, Deposits & DMBs Assets(y-o-y)
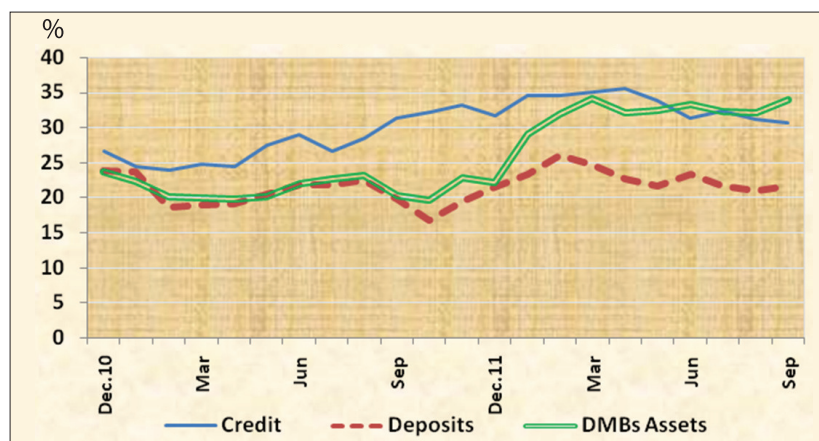
4.1.2   Credit Risk Indicator

Credit to the private sector continues to increase at an annual rate of more than 30% in September 2012, similar to 2011. Moreover, the ratio of loans to deposits increased to 92% compared to around 86% for the same month in 2011. To avoid credit risk, the NBC has upgraded bank supervision to strengthen onsite examination and adopted additional prudential guidelines, including: (i) the Central Bank's regulations on credit classification and provisioning, governance, internal control to increase resilience of Cambodia's banks and (ii) provided a license to the Credit Bureau to share credit information and collaborated with the International Finance Corporation to manage and examine the Credit Bureau. As a result, banking institutions have improved their risk management and non-performing loan (NPL) ratio which gradually declined to 2.8% from 3.3% in September 2011.

Figure 3
Non-Performing Loan
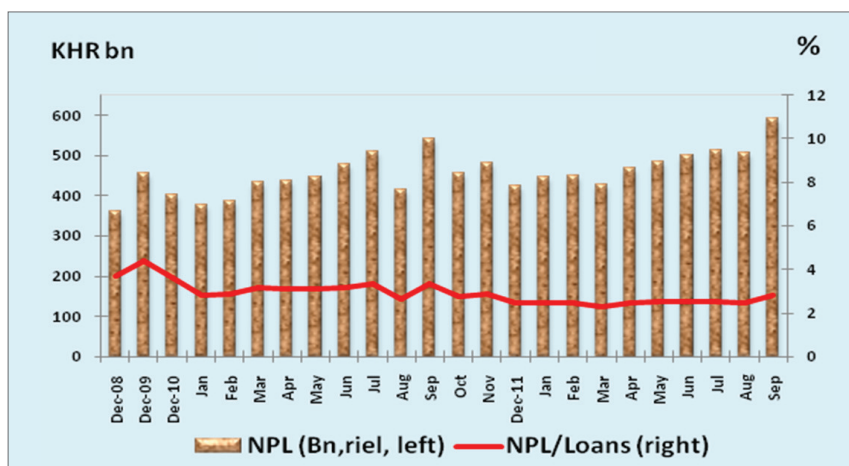
4.1.3 Liquidity Risk Indicator

The average liquidity coverage ratio for the whole banking system remained quite stable at around 83% as of September 2012, and was well maintained above the prudential norm of 50%. This indicates that the banking system does not face any liquidity risk since the banks mostly get long-term funds from their creditors and provide short-term credits to their customers and will not face any shortage of funds to meet any deposit withdrawals. Moreover, the banks hold a lot of idle cash and are not able to provide long-term credits to customers without creditworthiness.

Figure 4
Liquidity Ratio
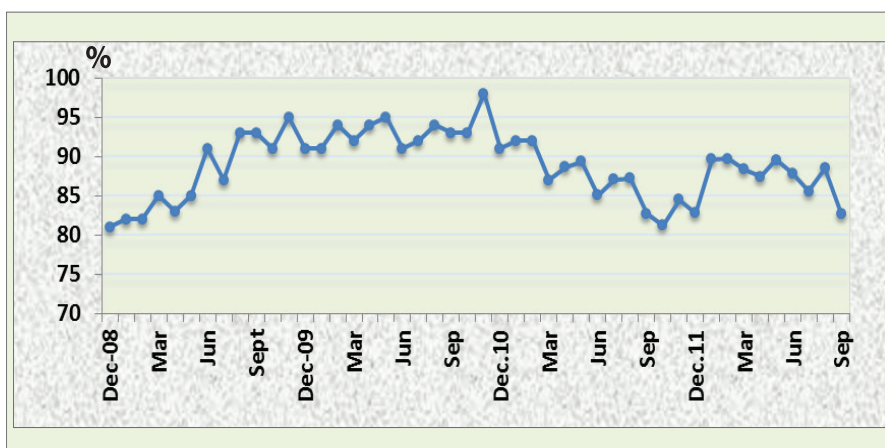
4.1.4 Insolvency Risk Indicator

The total net worth in the banking sector gradually increased by 31% (y-o-y) to US$ 1,817 million in September 2012, of which only 4.02% is Tier II capital. This increase was owing to the new banks. Even though the banks continue to extend credits to their customers, the ratio of bank capital to total assets remained the same at around 20% for 2011, while the solvency ratio was quite stable at an average of 27%. This ratio remained much higher than the prudential limit and the early warning threshold of 15%. This figure indicates that banks have the ability to absorb the risk weighted assets up to 27% by using their net worth.

Amidst the global economic slowdown, the Cambodian banking system remains sound and healthy due to lower non-performing loans, higher liquidity and solvency ratios than their thresholds.

Figure 5
Net Worth Growth and Solvency Ratio
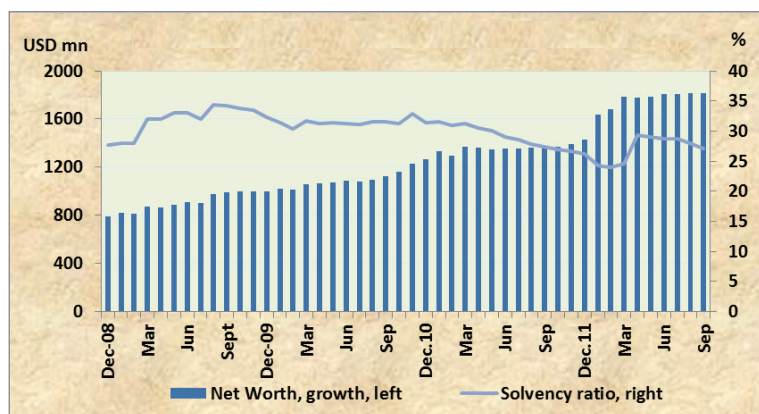
4.2 Macroeconomic Variables

Cambodia's macroeconomic performance during 2011-2012 has to be assessed in the context of the modest global growth and downside risks which are still elevated.

In 2012, advanced economies have performed relatively poorly while emerging market economies have performed better. Consumer demand, public confidence and willingness to lend remain weak in many developed economies. Increasing high public and private debts, issues on U.S. sudden fiscal contraction and uncertainties in the policy direction of Eurozone countries are hampering world recovery, threatening the fragile global financial stability and hurting global economic prospects.

Cambodia's macroeconomic management has responded to these external uncertainties by maintaining market confidence and pursuing targeted socio-economic policies. Economic growth was 7.1% in 2011 and estimated to grow at the same rate in 2012, in spite of the global economic slowdown. Rising public and private investments, rebound in industry – especially garment exports, continued robust growth in the service sector – mainly in tourism related activities combined with strong growth in financial sector and relatively good performance of agriculture – particularly rice production and exports have underpinned this performance.

4.2.1 Growth Rate

Reflecting the 7.1% GDP growth in 2011, income per capita rose by about 10% to reach US$ 911 in 2011. For 2012, GDP is estimated to grow at around 7%, with per capita increase to US$ 990. The notable achievements during 2011-2012 are presented below:

- Exports increased by 22.7% in 2011 over 2010 to reach US$ 4.77 billion. In 2012, exports are expected to rise by 17.1%.
- Rice exports reached about 170,000 tons in 2011 and expected to double in 2012.
- Tourist arrivals increased by 15% over 2010 and in 2012, the country is expected to receive about 3 million of tourists.
- Inflation was contained at about 5% (y-o-y) in 2011 and expected to further suppress to below 3% notwithstanding continued increase in commodity and petroleum prices.

However growth of the Cambodian economy is yet to recover to the double digit levels seen prior to the Crisis.

Figure 6
GDP Growth Rate
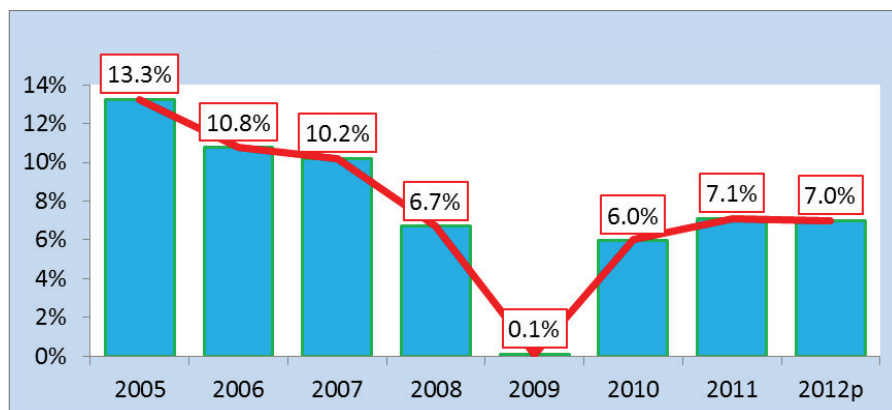
4.2.2 Inflation

The inflation rate eased during the first 3 quarters of 2012. The y-o-y headline and core inflations averaged 3.4% and 2.8% respectively during the above mentioned period compared with 5.5% and 2.7% for the same period of 2011.

In particular, in September 2012, on a y-o-y basis, the headline and core inflations decreased to 1.4% and 2% respectively from 6.7% and 3.1% in the same period of 2011. The decrease in inflation was due to: (i) the increases in domestic supply causing the prices of certain goods such as fish and seafood and meat to decrease; (ii) the slower increases in the prices of imported goods from the trading partners; and (iii) the appreciation of domestic currency against the trading partners, and ease of world oil price during that period.

Figure 7
Inflation: Dec 2009-Sep 2012 (y-o-y, %)
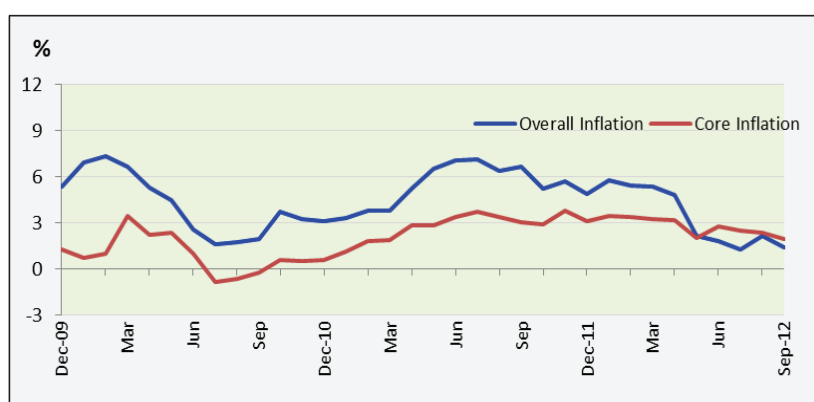
Figure 8
CPI: Contribution of Subgroups

87
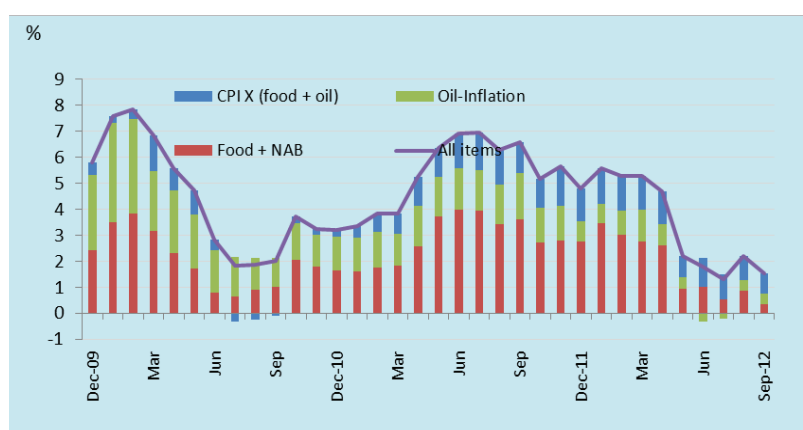
4.2.3 Exchange Rate

During the first 10 months of 2012, the riel's exchange rate remained relatively stable against the US dollar, fluctuating between 3,995 riel and 4,100 riel per USD. In October 2012, the riel's exchange rate against US$ was 4,025 riel per US$, an appreciation of 1.64% (y-o-y) while for the first 10 months of the same year, on average, it was 4,052 riel per US$, an appreciation of 0.52% compared to the same period of 2011. An increase in the domestic demand for riel for tax payment and the beginning of tax collection on real estate, and the depreciation of U.S dollar in the global market and greater capital inflows supported the value of the riel.

Figure 9
End-Month Exchange Rate KHR/USD
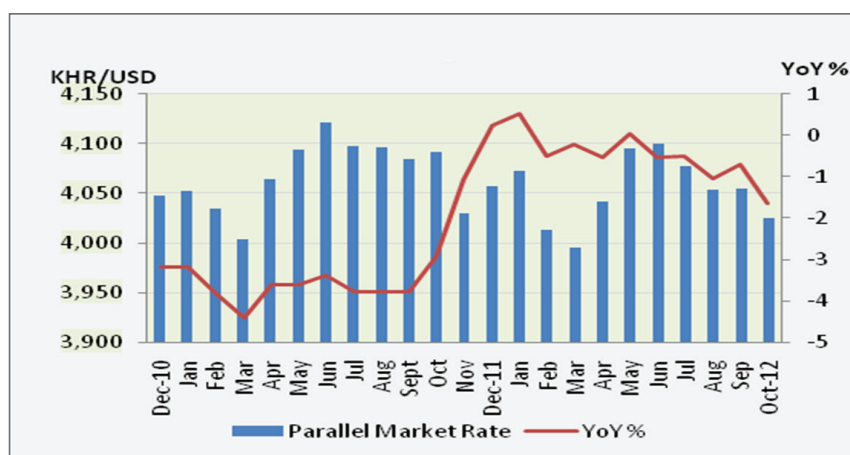
4.2.4 Balance of Payment

Cambodia's balance of payments transactions for the first semester of 2012 registered an overall balance surplus of US$ 196 million, a decrease of 4% compared to the same semester in 2011. This shows that although the US and EU economies are still facing many challenges, the external demands from developed countries for Cambodian goods and services have continued to grow.

The current account balance (excluding official transfers) registered a deficit of US$ 779 million in the first semester of 2012, an increase of 5% from the same semester in 2011. The main factors contributing to this increase was the rise in the trade balance deficit, income account deficit and service account surplus.

In the meantime, domestic exports rose to US$ 2,601 million, an increase of 13% compared to the same period in 2011 as a result of the main surge in garment exports covering 73% of exports. However, the retained imports of goods amounted to US$ 3,654 million, up 14% from the same period in 2011, owing to the increases of imported goods such as garment materials, petroleum and electricity.

Figure 10
Trade Balance
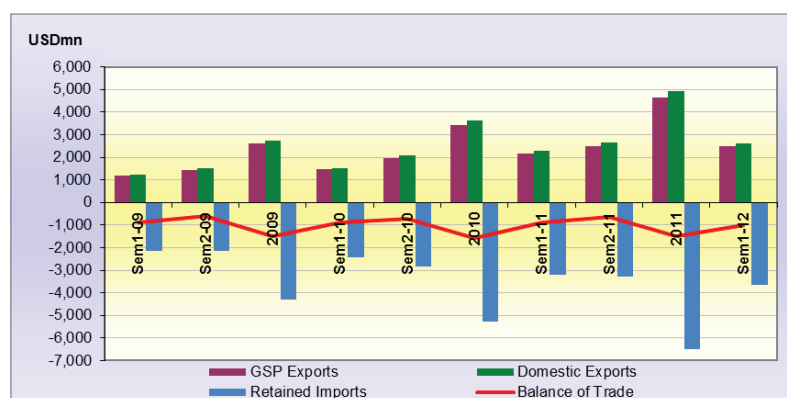
Source: National Bank of Cambodia

Moreover, the service account surplus amounted to US$ 517 million, up by 51% from the same semester in 2011. The proportion of travel in service receipt is much larger than that of transportation while the share of travel in services payments is much smaller than that of and transportation. In addition, the income account deficit expanded to US$ 349 million, an increase of 13% from the same period in 2011. The interest income dominates the income receipts while equity income occupies the majority of income payment.

5. Strengthening FSIs

As mentioned earlier, the financial system in Cambodia is at a rudimentary stage of development. Wrecked by almost three decades of domestic conflict, the basic economic and social infrastructure of Cambodia, including its financial system, were completely destroyed. Cambodia regressed to a barter economy and public knowledge about the role of financial institutions was almost erased. The economy went through a slow and painful process of rehabilitation. The intermediary role of the financial sector was progressively restored and the financial institutions regained public confidence.

6. Policy Recommendation

The main goal of the monetary policy is to maintain price stability in the context of the overall economic policies of the Royal Government of Cambodia, to support a sustainable and broad-based economic growth. As Cambodia's economy is highly dollarised, stable exchange rate of the Riel against the US dollar is a key factor contributing to stabilising the general price level.

6.1 Monetary Policy and Exchange Rate Policy

Cambodia is a high dollarised economy and nearly all transactions in either business or daily living are in US dollars. The ratio of foreign currency deposits to total deposits was 97% for the period of January 2002-September 2012. However, during the last nine months of 2012, the average of this ratio has shown a downward trend to 96% from 97% for the same period of 2011. Nevertheless, it is still very high compared to other SEACEN economies. Moreover, Cambodia is a cash-based economy with the absence of an interbank market. This would not enable NBC, the central bank, to conduct its monetary policy broadly and effectively.

Currently, with the absence of open market operations and a discount window, the NBC has the following monetary policy instruments: (i) foreign exchange invention, (ii) reserve requirement and (iii) standing facilities consisting of fixed deposit, overdraft facility and refinancing window. Among the three tools, foreign exchange intervention has been actively utilised to maintain foreign exchange stability to promote price stability while the second and third ones have rarely been used.

Cambodia adopted a managed floating exchange rate regime in 1992 based on the US dollar. The NBC intervenes in the foreign exchange market to smooth

the foreign exchange movements through foreign exchange auctions, and to defend against speculative attack as market sentiments and psychological factors cause disorders in the foreign exchange market. Foreign exchange market intervention has been frequently implemented to keep the Riel against US dollar exchange rate volatile within +/-1% of the official exchange rate. During the last two years, NBC has not conducted any foreign exchange interventions since the Riel has remained stable.

Recently, since credits provided by banks to the private sector continue to increase at a faster pace compared to neighbouring economies, NBC decided to increase the required reserve ratio for foreign currency by 0.5% to 12.5% effective as of September 2012, while the required reserve ratio for local currency remain at 8% in order to prevent any financial risk and to promote the use of local currency in the future.

The last tool the NBC has implemented are standing facilities comprising of (i) fixed deposits, (ii) overdraft facility and (iii) refinancing window. The NBC operates fixed deposit facilities in both US$ and Riel with maturities of three, six and twelve months to managing liquidity due to the absence of an interbank market. The NBC introduced the overdraft facility to help eligible institutions to overcome temporary or short-term liquidity shortages to mitigate the risks arising from liquidity shocks. Lastly, the NBC provides a swap window to banks and other financial institutions to facilitate microfinance lending to specified sectors (agriculture loans in the rural sector).

Meanwhile, interbank market development is well underway and the operational procedures and trading system for the launch of negotiable certificate of deposits (NCDs) have been almost finalised. As the NCDs market is envisaged as the first step in the development of a full-fledged money market, the Central Bank also wishes to use this channel to effectively exercise its monetary policy in the future.

6.2 Financial Stability Measures

Since there are many investment potentials for foreign investors, the number of banks has continued to increase from time to time, attracting capital inflows into Cambodia. It would be necessary for the NBC to be prepared for uncertainties and to mitigate the downward risks of the world economy and to

enhance the efficiency and stability of the banking system. Thus several measures have been implemented, including:

- **Enhancement of Banking Supervision.** This is an ongoing effort of the NBC and has been conducted periodically to assess banks' compliance with existing laws and prudential regulations. In light of the recent global financial crisis and the procyclicality in the financial system and its effects on the macro-economy, it is vital to make the supervision framework more prudent and to expand the scope of supervision to ensure that banks manage their risks efficiently, improve corporate governance, and adequately define their strategic aims.

- **Risk-based and Forward-looking Supervision.** In order to anticipate potential adverse developments and address them in a timely manner by issuing adequate injunctions to implement required corrective actions, in a responsive and effective manner, the NBC has expanded the scope of supervision to ensure robust bank management by moving from rule-based supervision to risk-based and forward looking supervision and upgrading the early warning system and prompt corrective actions.

- **Capacity Building.** Since the financial system in Cambodia has become increasingly complex and deeper, analytical skills in financial and banking sector for macro-surveillance should be improved in order to respond to unexpected risks.

- **Credit Bureau:** In addition to the management of credit risks, the Credit Bureau has been established to support the reporting operation and information sharing systems in Cambodia, with the aim of strengthening reliable, competitive, responsible, and effective lending.

7. Conclusion

Cambodia's financial sector is vibrant, competitive and rapidly expanding. Value added by the financial sector expanded at an average annual rate of 21.1% during 2004-2008, reflecting rapid financial deepening and the increase in financial intermediation. The sustained increase in the deposits and loans of the commercial banks reflects growing public confidence in the banking sector. The lending by banks and microfinance institutions has diversified across the economic sectors.

Notwithstanding the above, Cambodia's finance sector is still evolving and lacks many features of a well-developed financial market infrastructure. The key weaknesses include overdependence on the banking sector for resource mobilisation, lack of human resources and capacity to regulate and supervise the financial system, concentration of financial assets in a few large banks which poses a systemic risk, inadequate oversight of the non-banking sector, lack of coordination and information exchange among the various regulatory agencies, and poor rural financial services.

The turmoil in the international financial markets has had limited direct impact on the banking sector of Cambodia. The contagion originated predominantly from the global recession and its effect on the Cambodian economy was mainly through the trade and investment channels. The contraction in global demand impacted somewhat Cambodia's export market, decreased tourism income and caused a burst in the real estate bubble. This was also one major reason why the global crisis only reached the Cambodian economy much later than other Asian economies that were far more integrated from a financial point of view.

Moving forward, the NBC will continue to work on enhancing monetary policy tools and on creating the incentive for banks to properly and adequately manage their risks; strengthening public confidence in the sector and thus contributing to the maintenance of macroeconomic stability and reduction of poverty.

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Chapter 3

FINANCIAL SOUNDNESS INDICATORS (FSIS) AND FINANCIAL STABILITY INDICATORS (FSIX) IN KOREA

By
Jinshik Son[1]

1. Introduction

The recent global financial crisis has several features that distinguished it from other fluctuations previously. Only a few experts were able to anticipate the possibility of this gigantic fluctuation and perceive its severity in advance. We could not help but be astonished by the speed of its transmission, through transatlantic fluctuation. As mentioned by Trichet (2011), it took only days for the crisis to spread around the world. And even though most financial institutions had been well managed under the regulations, the crisis came about through a totally different dimension – namely, the outbreak of systemic risk.

The recent crisis presented many challenges to monetary authorities, regulators and market participants. One of the fundamental challenges is the development and strengthening of financial stability indicators. If we are able to capture signs of potential risks and understand the seriousness of the expected fluctuations in advance, it will be possible for us to find ways of avoiding or reducing the related losses.

This paper summarises the efforts of the Bank of Korea (BOK) to accomplish this task. Section 2 provides a survey of the literature on the development of financial stability indicators. Section 3 summarises the existing financial soundness indicators (FSIs) of Korea, in accordance with the IMF compilation guide. Section 4 describes the structure of the Korean financial system, including its financial institutions and markets. Section 5 depicts the potential risks of the Korean economy measured from the viewpoint of financial stability and in light of the recent Korean economic performance. Section 6 highlights some of the attempts by the BOK to strengthen financial stability indicators (FSIxs). Section 7 then offers several policy implications and conclusions.

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1. Author is from the Banking Research Team, Financial System Stability Department of the Bank of Korea. The views expressed in this paper are those of the author, and do not necessarily reflect the stance of the Bank of Korea or The SEACEN Centre.

2. Literature Survey

One of the stylised facts on the global financial crisis is a sudden contraction of leverages in recession, which have been accumulated and expanded in the boom time. This phenomenon is concerned with the procyclical propensity of financial crisis. Procyclicality describes amplitude amplification in business cycle with interaction of credit expansion and contraction in the financial sector.

Interconnectedness is suggested as another potential risk factor. In the financial sector, a problem in an individual institution can spread out to affect the whole system comparatively quickly due to the connectedness among the financial institutions and instruments. These two dynamic time-series procyclicality and cross-sectional structure are difficult to measure or monitor in the study of financial systemic risk and stability.

Many trials have been carried out to measure and monitor the risk or stability in a banking and financial system. Elsinger, Lehar and Summer (2002) estimated the bilateral inter-bank exposures in the Austrian banking system. They estimated the likelihood of contagious defaults using a network model of inter-bank market. They found that the correlation of banks asset portfolios contribute more to systemic risk than to contagion. Lehar (2005), using Metron (1974), tried an approach modeling the individual liabilities that a regulator has to each bank as contingent claims on the bank's assets. Adrian and Brunnermeier (2009) proposed "CoVar" as a measure for systemic risk. The CoVar is the value at risk (VaR) of financial institutions conditional on other institutions being in distress. They defined an institution's (marginal) contribution to systemic risk as the difference between CoVaR and the financial system's VaR. In their analysis, they adapted the quantile regression. Acharya, Pedersen, Philippon and Richardson (2010) suggested a "Systemic Expected Shortfall (SES)" indicator and showed that each financial institution's contribution to systemic risk can be measured as its SES, i.e., its propensity to be under-capitalised when the system as a whole is under-capitalised. Giesecke and Kim (2011) developed dynamic measures of the systemic risk of the financial sector as a whole. They defined a systemic risk as the conditional probability of failure of a sufficiently large fraction of the total population of financial institutions. This definition recognises that the cause of systemic distress is the correlated failure of institutions to meet obligations to creditors, customers, and trading partners. The likelihood estimators of the failure probability are based on a dynamic hazard model of correlated failure timing that captures the influence on failure timing of time-varying macroeconomic and sector-specific risk factors, and of spillover effects. Adrian and Shin (2009) focused on continuous asset price changes in balance sheets by marked-to-

market and financial intermediaries' behaviours to adjust the size of their balance sheets. They presented evidence that marked-to-market leverage is strongly procyclical and argued that such behaviour has macro level consequences.

3. Financial Soundness Indicators in Korea

3.1 Overview

Korea has compiled and periodically updated 35 financial soundness indicators (FSIs) specified in the IMF guide, while excluding five that are difficult to compile owing to lack of basic statistics. The reported indicators include those on deposit-takers, other financial corporations, non-financial corporations, households, and the securities and real estate markets.

Table 1
FSIs Excluded From Compilation

Indices Excluded	Reasons for Exclusion
Interbank interest rate spread	KORIBOR (the interbank interest rate in Korea) not representative
Non-financial corporations' net foreign exchange exposure-to-equity ratio	Insufficient statistics
Non-financial corporations' earnings-to-interest and principal expenses	Insufficient statistics
Household debt service and principal payments to income	Insufficient statistics
Commercial real estate prices	Insufficient statistics

Five institutions take responsibility for producing these 35 indicators in Korea, and the Financial Supervisory Service (FSS) aggregates them and conducts a final review before submitting them to the IMF. Among these indicators, the FSS produces 25 of them, concerning deposit-takers and other financial corporations. The BOK compiles six indicators, including one for deposit-takers and five for the non-financial corporation and household sectors. The Financial Investment Association (FIA) produces two indicators concerning the stock market, and the Supreme Court and Kookmin Bank provide one indicator each – for corporate defaults and housing prices, respectively.

The IMF allows posting periods of monthly, quarterly, semi-annually and annually, and recommends a quarterly period. Korea posts most of its indicators quarterly and annually, with the exceptions of two corporate-related indicators, debt ratio and ROE, which are posted only annually in reflection of their raw data production cycles. In the case of annual postings, Korea submits its data by the end of the first quarter of the following year. Even though the IMF recommends inclusion of all deposit-takers in calculating the indicators, Korea's compilation covered only domestic banks and the branches of foreign banks. Other non-bank deposit-takers, accounting for only 17% of total deposit-taker assets, are excluded. This is because they are regulated under different prudential rules than those applied to banks, and because compiling the indicators concerned would be excessively expensive, given the great number of these institutions (over 4,000).

Meanwhile, deposit-taker indicators have been compiled for three groups: (1) Domestic Banks (cross-border, cross-sector consolidation for all domestically incorporated deposit-takers); (2) Native Banks (domestically controlled, cross-border, cross-sector consolidation); and (3) Foreign Bank branches.

The IMF recommends compiling deposit-taker-related indicators on a consolidated basis. In the case of Korea, the BIS ratio and the RADARS (Risk Assessment and Dynamic Analysis Rating System) index[2] have been compiled in accordance with that standard. The sorts and methods of compilation of Korea's other indexes differ from the IMF standards, however, and so comparison with other countries would require additional reporting by banks.

3.2 FSIs for Deposit-takers

Korea has compiled 12 core indicators and 15 encouraged ones under the categories of capital adequacy, capital soundness, profitability and liquidity. They include not only indicators similar to the IMF FSIs, such as the BIS ratio, liquidity ratio, etc., but also others not considered by the IMF.

3.2.1 Capital Adequacy

The domestic standards for BIS ratio compilation are the same as those recommended by the IMF. In the case of the simple capital ratio, the result of compilation by IMF standards shows a figure that is little bit higher than that

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2.   A risk-based monitoring system used by Korean FSS (financial supervisory service) for evaluating banks business behaviors

of compiled by domestic standards. This is caused by the fact that the IMF standards include intangible assets and are aggregated on a consolidated basis, while the domestic standards do not apply those criteria:

Table 2
FSIs on Capital Adequacy

(Percent)

	IMF Standards			Domestic Standards (Similar Indices)	
	Domestic	Native	Foreign Branches	Domestic	Name of Index
(Core) Regulatory capital-to-risk-weighted assets	12.31	12.30	17.91	12.31	BIS capital ratio
(Core) Regulatory Tier 1 capital-to-risk-weighted assets	8.84	8.76	11.75	8.84	BIS Tier 1 Capital ratio
(Encouraged) Capital-to-assets	6.30	6.33	3.20	6.26	Capital ratio

Source: Financial Supervisory Service.

3.2.2   Capital Soundness

Because the IMF standards apply less strict criteria than domestic ones, the NPL ratio compiled in accordance with them is lower than that compiled under the domestic standards. The IMF standards use a consolidation basis which includes credit granted by subsidiaries, but these are not included in the domestic ratio. Native banks exhibit higher NPL ratios and larger exposure-to-capital ratios compared to foreign bank branches including subsidiaries:

Table 3
FSIs on Capital Soundness

(Percent)

	IMF Standards			Domestic Standards (Similar Indices)	
	Domestic	Native	Foreign Branches	Domestic	Name of Index
(Core) Non-performing loans net of provisions-to-capital	3.17	3.31	0.79	-	-
(Core) Non-performing loans-to-total gross loans	0.57	0.58	0.26	0.86	NPL ratio
(Encouraged) Large exposures-to-capital	76.62	79.49	41.60	70.91	Large exposure ratio

Source: Financial Supervisory Service.

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Most domestic banks' loans comprise corporate loans and household loans. Among corporate loans, the manufacturing, construction and real estate sectors take up the highest portions. In the case of foreign bank subsidiaries, it is characteristic that the proportions of their loans to financial institutions and non-residents are comparatively high, and those to the construction and real estate sectors on the other hand low:

Table 4
Loan Distribution
(Percent)

Sectoral Loan Distribution (Core)				Corporate Loan Distribution, by Industry			
	Domestic	Native	Foreign Branches		Domestic	Native	Foreign Branches
Residential	94.17	94.29	73.18	Manufacturing	23.31	23.61	18.45
Central bank, government	1.12	0.96	0.95	Construction, real estate	12.36	13.03	2.26
Financial institutions	3.53	3.75	28.10	Wholesale, retail	7.06	7.07	6.44
Corporate	54.81	56.26	36.29	Accommodation, restaurants	1.66	1.74	0.14
Household	34.71	33.32	7384	Transportation	2.48	2.58	0.74
Non-residential	5.83	5.71	26.82	Others	7.94	8.23	8.26
Total	100.00	100.00	100.00	Total	54.81	56.26	36.29

Source: Financial Supervisory Service.

The largest proportions of non-resident loans, at both native banks and foreign bank subsidiaries, are made to industrialised countries, followed by those of loans to Asia (including China) and to South America:

Table 5
Regional Loan Distribution
(Percent)

	Residential	Non-residential					
		Industralised Countries	Asia	South America	Middle East	Eastern Europe	Others
Domestic	94.17	2.55	1.72	0.62	0.46	0.24	0.24
Native	94.29	2.37	1.69	0.65	0.50	0.25	0.25
Foreign subsidiaries	73.18	8.99	6.00	4.34	5.38	1.07	1.04

Source: Financial Supervisory Service.

On the other hand, real estate-based loans make up about 38% of total lending in the case of domestic banks, while for foreign bank subsidiaries they account for only 6.5%:

Table 6
Real Estate Loan Ratio
(Percent)

	IMF Standards			Domestic Standards
	Domestic	Native	Foreign Branches	
(Encouraged) Residential real estate loans-to-total gross loans	19.64	19.01	6.33	-
(Encouraged) Commercial real estate loans-to-total gross loans	18.58	19.21	0.19	-

Source: Financial Supervisory Service.

3.2.3   Earnings and Profitability

The profitability indicators compiled under the IMF standards using pre-tax earnings are higher than those compiled under domestic standards. Compared to foreign banks, native banks exhibit higher dependence on interest margins in their total earnings, lower financial instrument operation profits, and lower profit creation ability indicators, such as ROA and ROE:

Table 7
FSIs on Earnings and Profitability
(Percent)

	IMF Standards			Domestic Standards	
	Domestic	Native	Foreign Branches	Domestic	Name of Indicator
(Core) ROA	0.67	0.63	1.25	0.47	ROA
(Core) ROE	9.91	9.10	33.56	7.08	ROE
(Core) Interest margin-to-gross income	66.62	66.42	41.26	-	-
(Core) Non-interest expenses-to-gross income	60.22	61.42	24.59	62.34	Expense compensation ratio
(Encouraged) Trading income-to-total income	6.02	3.86	50.37	-	
(Encouraged) Personnel expenses-to-non-interest expenses	28.00	27.33	32.40	-	

Source: Financial Supervisory Service.

3.2.4   Liquidity

The liquidity ratio is compiled under the IMF standards as a single index applying the three-month criterion without distinction between domestic and foreign currencies. The result is similar to a weighted average using the ratios of domestic and foreign currencies:

Table 8
FSIs on Liquidity
(Percent)

	IMF Standards			Domestic Standards	
	Domestic	Native	Foreign Branches	Domestic	Name of Indicator
(Core) Liquidity assets-to-total assets	35.27	32.26	45.11	-	-
(Core) Liquidity assets-to-short-term liabilities	101.37	96.79	100.65	102.98	Domestic currency liquidity ratio (3-month)
				94.73	Foreign currency liquidity ratio (3-month)

Source: Financial Supervisory Service.

3.2.5 Indicators Related to Foreign Currency

In their foreign assets and liabilities ratios, native banks exhibit relatively low values compared to foreign banks. The total foreign positions of domestic and foreign banks at end-2008 were long positions, meaning that their assets were greater than their liabilities:

Table 9
FSIs on Foreign Currency
(Percent)

	IMF Standards			Domestic Standards	
	Domestic	Native	Foreign Branches	Domestic	Name of Indicator
(Core) Net open position in foreign exchange-to-capital	8.38	7.62	19.65	-	-
(Encouraged) Foreign currency-denominated loans-to-total loans	13.34	12.40	74.76	-	-
(Encouraged) Foreign currency-denominated liabilities-to-total liabilities	14.89	13.76	60.50	-	-

Source: Financial Supervisory Service.

3.2.6 Other Indicators

Korea also provides other encouraged FSIs concerned with the banking sector, such as derivative assets (liabilities) to total capital, deposit-to-loan interest rate spreads, equity net open position ratios to capital, etc.

3.3 FSIs for Other Sectors

Korea provides nine out of the 13 IMF-recommended indicators for sectors other than banking including other financial corporations, non-financial corporations, households, and the securities and real estate markets.

3.3.1 FSIs for Other Financial Corporations

These include two indicators representing the share of other financial corporations other than deposit-takers in the overall financial system. The indicators as of 2008 exhibited small increases compared to those of 2005:

Table 10
FSIs on Other Financial Corporations
(Percent)

	2008	2005	Compilation Agency
(Encouraged) Remaining financial assets-to-total financial assets	12.46	12.23	BOK
(Encouraged) Remaining financial assets-to-GDP	96.22	85.54	BOK

Source: Bank of Korea.

3.3.2 FSIs for Non-financial Corporations

Korea provides three indicators out of the five IMF-recommended ones for non-financial corporations, including the debt ratio. In the non-financial corporation sector, as of 2008, the ROE had decreased and the number of bankruptcy petitions had increased by 48% as compared to 2005, while the debt ratio had exhibited a slight improvement:

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Table 11
FSIs for Non-financial Corporations
(Percent)

	2008	2005	Compilation Agency
(Encouraged) Gross debt-to-gross capital	106.47	110.86	BOK
(Encouraged) ROE	15.83	17.94	BOK
(Encouraged) Petitions for bankruptcy (unit: number)	191	129	Office of Court Administration
(Encouraged) Profit-to-repayment of principal**	excluded	460.30	BOK
(Encouraged) Net foreign exchange exposure-to-gross capital	excluded	excluded	BOK

* Debt Ratio and ROE are for end-2007.
** Calculated by the business profits-to-interest payments ratio in 2005, but now excluded because of concerns about distortion of comparisons among countries since the repayment of principal is not included.
Source: Bank of Korea, Office of Court Administration.

3.3.3 FSIs for Households

Korea provides the debt ratio only for households, and the ratio had increased slightly as compared to that of 2005:

Table 12
FSIs for Households
(Percent)

	2008*	2005	Compilation Agency
(Encouraged) Household debt-to-GDP	83.88	80.22	BOK
(Encouraged) Repayment of principal-to-income	Excluded	5.68	BOK

*Calculated by household income-to-interest payments ratio in 2005, but for 2008 excluded because of concerns about distortion of comparisons among countries since the repayment of principal is not included.
Source: Bank of Korea, Office of Court Administration.

3.3.4 FSIs for Securities Markets

Changes in indicators such as the contraction in bid-ask spreads and the increase in the daily turnover ratio might seem to represent a revitalisation of the securities market compared to 2005. However, they are in fact due to the change of compilation method. In 2008, the indicators included over-the-counter transactions by the Korean Financial Investment Association, while for 2005 they included transactions conducted on the Korea Stock Exchange only.

3.3.5 FSIs for Real Estate Markets

The house price indices calculated by Kookmin Bank, one of the domestic banks in Korea, showed an increase of 3.1% in 2008:

Table 13
FSIs for Real Estate Markets
(Percent)

	2008	2005	Compilation Agency
(Encouraged) House Price Index (annual growth rate)	3.10	4.00	KB
(Encouraged) Commercial Real Estate Price Index (annual growth rate)	Excluded	Excluded	KB

Source: Kookmin Bank.

4. Structure of Korean Financial System

4.1 Overview

The foundations of the modern financial system in Korea were laid during the early 1950s when the central and commercial banking systems were realigned under the new institutional bases provided by the Bank of Korea Act and the Banking Act. Specialised banks were also established in order to strengthen financial support for the underdeveloped or strategically important sectors.

Most of the non-bank financial institutions were introduced during the 1970s in order to diversify financing sources, promote the development of the money market, and attract funds into the organised market. From the early 1980s, several commercial banks and non-bank financial institutions were added as part of a series of broad measures to spur financial liberalisation. This coincided with a shift from a government-orientated stance on economic policy towards a market-orientated stance.

Since the outbreak of the financial crisis toward the end of 1997, the Korean financial system has been undergoing substantial changes in the course of a comprehensive financial reform programme.

The financial institutions in Korea may be divided into seven categories by substance and function: (i) a central bank, which is the Bank of Korea; (ii) banking institutions including commercial and specialised banks; (iii) non-bank depository institutions including merchant banking corporations, mutual savings banks, credit institutions, etc.; (iv) insurance institutions; (v) financial investment business entities; (vi) other financial institutions; and (vii) financial auxiliary institutions.

4.2 Financial Institutions

4.2.1 Bank of Korea

The Bank of Korea was founded on June 12, 1950 under the Bank of Korea Act. The Bank was originally established with a capital of 1.5 billion won, all of which was subscribed by the government, but the revision of the Bank of Korea Act in 1962 made the Bank a special juridical person having no capital.

The primary purpose of the Bank, as prescribed by the Act, is the pursuit of price stability. The Bank sets an inflation target in consultation with the government and draws up and publishes an operational plan for monetary policy.

The Bank performs the typical functions of a central bank: issuing bank notes and coins, formulating and implementing monetary and credit policy, serving as the banker's bank, and the government's bank. In addition, the Bank of Korea undertakes the overall management and surveillance of the payment and settlement systems, and manages the nation's foreign exchange reserves. It also monitors the financial system and assesses its stability.

Figure 1
Financial Institutions in Korea

Central Bank	The Bank of Korea
Banking institutions	Commercial banks
	Specialized banks
Non-bank depository institutions	Merchant banking corporations
	Mutual savings banks
	Credit institutions, etc.
Insurance institutions	Life insurance companies
	Non-life insurance companies
	Postal Insurance, etc.
Financial investment business entities	Securities companies
	Asset management companies
	Futures companies
	Securities finance companies, etc.
Other financial institutions	Credit specialized financial companies
	Venture capital companies
Financial auxiliary institutions	Financial Supervisory Service
	Korea Deposit Insurance Corporation
	Korea Financial Telecommunications & Clearings Institute, etc.

4.2.2 Commercial Banks

As of the end of September 2010, commercial banks consisted of seven nationwide commercial banks, six local banks, and 37 branches of foreign banks. Commercial banks have adopted the branch banking system with a nationwide or province-wide network. The total number of domestic branches of commercial banks amounted to about 5,601 as of end of September 2010.

Since business demarcation is quite strict, commercial banks can engage in very limited securities business, and were not allowed to engage in insurance business until August 2003. However, since then, bancassurance has been introduced to permit commercial banks to sell insurance products.

The ownership of a commercial bank's stocks by a single holder has been restricted since 1982, except in the case of a joint bank, a local bank, or where they are held by the government. This limit was set at 8% in 1982 and was

tightened to a 4% ceiling in 1994. In 2002, the single shareholder ceiling was raised to 10%. And, as the Banking Act was amended in June 2009, a non-financial business operator's limit on the holding of stocks issued by a bank was raised from 4% to 9%.

Foreign bank branches conduct their business under almost identical conditions to Korean banks nowadays as preferential treatment has been reduced and discriminatory business regulations lightened.

4.2.3   Non-bank Financial Institutions

Non-bank financial institutions can be broadly classified into five categories according to their business activities, namely non-bank depository institutions, insurance institutions, financial investment business entities, other financial institutions, and financial auxiliary institutions.

The Financial Investment Services and Capital Market Act was legislated in August 2007 and went into effect on February 4, 2009. Under its provisions, securities related companies, which had been regulated respectively by each Act, were consolidated into Financial Investment Business Entities.

Non-bank depository institutions consist of merchant banking corporations, mutual savings banks, credit institutions, and the postal savings system. Merchant banking corporations can engage in almost all financial businesses except insurance business. Mutual savings banks specialise in taking deposits and lending for the populace and small enterprises. Credit institutions such as credit unions, mutual credit facilities, and community credit cooperatives operate for mutual aid between members by taking deposits and lending. The postal savings system, which operates through post offices nationwide, is a public financial institution.

Insurance institutions consist of life insurance companies, non-life insurance companies, postal life insurance, and pensions.

Financial Investment Business Entities consist of investment traders, investment brokers, collective investment business entities, investment advisory business entities, discretionary investment business entities, and trust business entities; that is, under the Financial Investment Services and Capital Market Act, the former institutional regulatory regime was changed into a functional regulatory regime by adopting a "same regulation for the same function" approach.

4.3 Financial Markets

4.3.1　Money Market

The money market in Korea embraces the call market and a wide range of other financial markets including those for Monetary Stabilisation Bonds (MSB), negotiable certificates of deposit (CD), repurchase agreements (RP), commercial paper (CP), and cover bills (CB).

Since 1985, there has been a sharp increase in the outstanding balance of money market instruments. This has been chiefly prompted by product innovation and the expansion in the number of financial institutions handling such instruments. However, the scale of the money markets contracted except for the MSB and call markets in the course of financial and corporate restructuring. Most notably, the CP market shrank dramatically in the three years after the crisis. As the financial market stabilised as a result of financial and corporate restructuring, the markets for CD and CP rebounded from 2001, as did the RP market from 2000.

Table 14
Money Market Trends
(Balance as of End of Period)
(Trillion won)

	1990	1998	2000	2005	2006	2007	2008	2009	2010.6
Call*	3.7	16.0	12.9	34.6	28.6	27.9	22.2	27.6	30.9
MSB**	15.2	45.7	66.4	155.2	158.4	150.3	126.9	149.2	167.6
CD	6.8	15.7	14.2	63.9	79.8	112.8	116.6	113.3	72.6
RP	3.4	17.5	26.3	42.9	58.4	68.3	67.3	67.7	72.5
CP	22.7	19.9	9.1	20.0	27.6	45.3	53.4	37.8	37.1
CB	0.3	4.1	11.2	4.0	3.7	4.4	3.5	2.6	1.7

* Daily average transactions during the last month in the period
** Monetary Stabilisation Bonds issued by the Bank of Korea
Source: Money and Banking Statistics, the Bank of Korea.

4.3.2 Capital Markets

The growth of the capital markets in Korea has been substantial. Encouraged by government efforts and an improved investment climate and accompanied by rapid economic growth and the opening of the stock market, the role of the capital markets in mobilising funds continued to strengthen. The monthly value of stocks traded on the exchange swelled from 4.5 trillion won as of December 1990 to 107.6 trillion won as of June 2010 and that of bonds also burgeoned from 3.2 trillion won to 500.0 trillion won. Market capitalisation in terms of stocks included in Korea Composite Stock Price Index (KOSPI) increased from 79.1 trillion won as of the end of 1990 to 936.5 trillion won as of the end of June 2010.

Foreign direct investment in stocks was allowed in 1981 for the first time within a ceiling set on equity ratio of each individual issue. Thereafter, the government expanded the investment ceilings several times, completely lifting them in May 1998, except for investment in public corporations. The stock holdings of foreigners as a percentage of stock market capitalisation in terms of KOSPI soared remarkably from 13.7% at the end of 1997 to 33.3% as of the end of June 2010.

The opening of the bond market was sequenced later than that of the stock market, mainly in consideration of differences between domestic and foreign interest rates and the low domestic demand for bonds. In December 1997, immediately after the currency crisis, all restrictions on foreign investment in listed bonds were abolished. Foreign investment in bonds, however, remained lackluster with foreign holdings representing only 6.3% of all listed bonds as of the end of June 2010.

Table 15
Capital Market Trends
(As of End of Period)

	1990	2000	2005	2006	2007	2008	2009	2010.6
Stocks Number of listed companies (KOSPI)*	669	704	702	731	745	763	770	772
Composite stock price index	696.1	504.6	1,379.4	1,434.5	1,897.1	1,124.5	1,682.8	1,698.3
Traded value** (bil. won)	4.5	52.2	65.5	70.7	113.6	107.3	121.9	107.6
Market value (bil. won)	79.1	188.0	655.1	704.6	951.9	576.9	887.9	936.5
Bonds Traded value***	3.2	178.6	332.7	344.3	242.5	266.1	392.1	500.0
(bil. won)	(0.3)	(2.3)	(30.2)	(24.5)	(29.7)	(32.3)	(42.5)	(37.0)

* The Korea Composite Stock Price Index (4 Jan. 1980 = 100)
** Monthly average during the period
*** Monthly average during the period and figures in parentheses represent values traded on the stock exchange
Source: Korea Exchange, Korea Securities Dealers Association.

5. Potential Risks in Korean Economy

5.1 General Economic Feature in 2010

5.1.1 Economic Growth: Domestic Economy Continues an Upward Trend

Annual GDP growth accelerated at a rapid pace to reach 6.2% in 2010 from 0.3% the previous year owing to favourable exports and the recovery of domestic demand. By period, the GDP growth rate stood at 2.1% in the first quarter and 1.4% in the second quarter, quarter on quarter, as both exports and facilities investment increased sharply. However, it slowed down to 0.6% in the third quarter and 0.5% in the fourth quarter, influenced by a base effect in the wake of the faster growth in the first half. The year-on-year growth rate stood at 8.0% in the first half and 4.5% in the latter half.

Figure 2
Growth Rate Of Real GDP
(Compared With Previous Quarter)
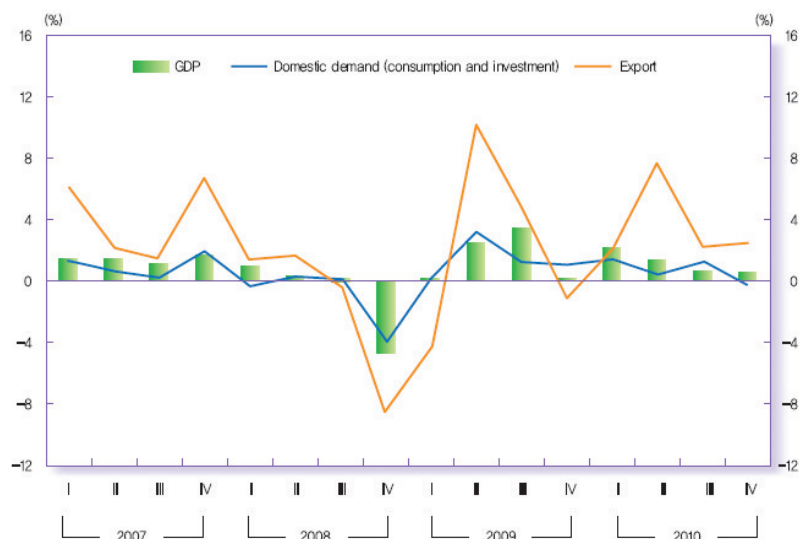
Source: BOK National Accounts.

By component of demand, annual consumption increased by 3.9% owing to an increase in household income and favourable consumption sentiment, following the improved employment situation and wage hikes. Fixed investment increased by 7.0% as facilities investment rose by 25.0% led by machinery, which served to offset a decrease in construction investment owing to a lackluster housing market.

Total exports of goods and services (real terms) increased by 14.5%, influenced by the global economic recovery and an improvement in domestic companies' international competitiveness. Total imports (real terms) rose by 16.9% owing to a base effect in the wake of a steep fall the previous year. Real gross national income (GNI) increased by 5.5%, lower than GDP growth, owing to the worsening of the terms of trade, following a rise in international oil prices and a fall in semiconductor prices.

Examining the distribution of national income (nominal NI), the share of compensation of employees in national income edged down from the previous year's 60.9% to 59.2% as businesses' operating surpluses showed faster growth than the compensation of employees.

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The gross savings ratio rose from the previous year's 30.2% to 32.0% and the gross domestic investment ratio went up from 26.2% to 29.2%.

Table 16
Domestic Economic Indicators

Unit : %, %p

	2008	2009	2010				
			Year	I	II	III	IV
GDP[1]	2.3	0.3	6.2	2.1 (8.5)	1.4 (7.5)	0.6 (4.4)	0.5 (4.7)
Final consumption	2.0	1.2	3.9	1.2 (5.9)	0.6 (3.4)	1.0 (3.4)	0.1 (3.0)
(Private)	1.3	0.0	4.1	0.5 (6.6)	0.7 (3.5)	1.4 (3.6)	0.3 (2.9)
(Government)	4.3	5.6	3.0	3.6 (3.4)	0.3 (2.9)	−0.1 (2.5)	−0.4 (3.2)
Fixed capital formation	−1.9	−1.0	7.0	2.1 (12.5)	0.2 (6.8)	1.9 (6.8)	−0.9 (3.4)
(Construction)	−2.8	3.4	−1.4	2.0 (4.3)	−4.2 (−2.3)	−0.8 (−3.1)	−1.0 (−2.9)
(Facilities)	−1.0	−9.8	25.0	2.8 (29.1)	7.9 (30.5)	5.6 (26.6)	−1.0 (15.9)
Changes in inventories[2]	0.6	−3.9	2.0	1.4 (2.7)	−0.2 (4.0)	−0.1(1.2)	−0.6 (0.3)
Exports	6.6	−1.2	14.5	2.2 (16.7)	7.8 (14.5)	2.3 (11.6)	2.6 (15.7)
Imports	4.4	−8.0	16.9	4.2 (21.5)	5.7 (18.0)	3.2 (14.7)	0.5 (14.2)
GNI[1]	−0.6	1.6	5.5	1.2 (9.6)	1.3 (5.6)	0.4 (4.5)	0.0 (3.0)
Unemployment rate[3]	3.2	3.6	3.7	4.3 (4.7)	3.4 (3.5)	3.6 (3.5)	3.5 (3.3)
Consumer prices[1]	4.7	2.8	2.9	1.0 (2.7)	0.9 (2.6)	0.9 (2.9)	0.9 (3.6)
Core inflation[1]	4.2	3.6	1.8	0.4 (1.9)	0.5 (1.6)	0.5 (1.8)	0.4 (1.9)
Current account ($100 million)	32.0	327.9	282.1	2.6	88.6	99.3	91.6
Exports (customs clearance basis)[1]	13.6	−13.9	28.3	(35.8)	(33.1)	(22.7)	(23.8)
Imports (customs clearance basis)[1]	22.0	−25.8	31.6	(37.4)	(42.8)	(24.6)	(24.6)
Yield on 3-Year Treasury Bonds[4]	5.27	4.04	3.72	4.14	3.74	3.70	3.30
Yield on 3-Year Corporate Bonds[4,5]	7.02	5.81	4.66	5.25	4.61	4.63	4.16
KOSPI (end-of-period)	1,124.5	1,682.8	2,051.0	1,692.9	1,698.3	1,872.8	2,051.0
KRW per USD (end-of-period)[6]	1,259.5	1,164.5	1,134.8	1,131.3	1,222.2	1,140.2	1,134.8

Notes : 1) The rate of increase or growth compared with the previous quarter. The figures in parenthesis are year-on-year rates.
2) Contribution to growth rate of GDP (%p)
3) The figures in parenthesis are not seasonally adjusted.   4) Average during the period
5) AA-degree basis   6) Based on closing price
Source : BOK ECOS.

5.1.2 Inflation: Consumer Prices Rise by 2.9 Percent

Consumer prices recorded an annual average rate of increase of 2.9%, closely approaching the mid-point of the medium-term inflation target. By period, headline inflation rose around the 2.5% level year-on-year in the first half, but hovered above the 3% mark in the latter half owing to a surge in prices of agricultural, livestock and marine products in the wake of unusually adverse weather conditions from September.

By category, the prices of agricultural, livestock and marine products and petroleum goods rose sharply, but the rate of increase of charges for services remained at a limited level. The prices of agricultural, livestock and marine

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products increased by 10.0% as prices of vegetables surged in the wake of abnormally high temperature and an increase in the number of rainy days and those of marine products soared owing to reduced catches of fish. Those of industrial products rose by 3.1%, centering on petroleum products.

The increase of charges for services by just 1.9% was due to the government's policy of keeping public utility charge increases to a minimum and to the slowing down in the rise of the individual service charges. However, house rents accelerated their upward pace during the year under the influence of a rise in leasehold deposit prices.

The rate of core inflation, which strips out the prices of non-grain agricultural products and petroleum-based fuels from the CPI, slowed down to 1.8% from the previous year's 3.6%.

In the real estate market, housing prices rose by 1.9% from the end of the previous year, showing a similar level to the previous year's 1.5%. By region, they fell in Seoul and its surrounding areas, influenced by regulations on loans, the expanded supply of low-cost housing and subdued housing purchase sentiment. In regions away from Seoul and its surrounding areas, however, they rose sharply owing to the inadequate supply of small and medium-sized apartments. Housing leasehold deposit prices posted a high rate of increase of 7.1% owing to a shortage of new houses available for occupation and a shift from leasehold deposit basis to a monthly rental basis that coincided with a growing preference for leasehold tenancies upon weakened expectations of higher housing prices.

Figure 3
Consumer Price Inflation and Core Inflation Rates[1]
(Year-to-Year)
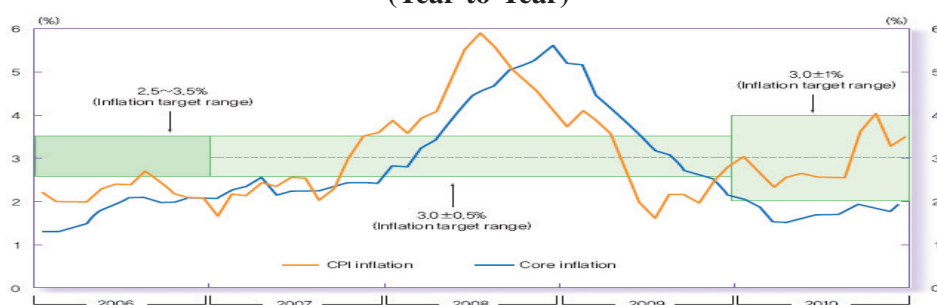
Notes : 1) Excludes the prices of non-grain agricultural products and petroleum-based fuels (along with city gas) from the CPI
2) The inflation target was set in terms of core inflation in 2006 and CPI inflation in 2007~2010.

Source : Statistics Korea Consumer Price Trends.

5.1.3 BOP: Current Account Continues in Surplus

The current account registered a surplus of US$28.2 billion, centering on the goods account, following the previous year's surplus of US$32.8 billion. The goods account surplus expanded from the US$37.9 billion of the previous year to US$41.9 billion.

Exports (customs-clearance basis) increased by 28.3% to total US$466.4 billion, posting a record high, and imports (customs clearance basis) rose by 31.6% to total US$425.2 billion. The services account deficit widened from the previous year's US$6.6 billion to US$11.2 billion in response to an increase in the payment of overseas travel expenses and royalties for intellectual property rights.

The capital and financing account, which excludes reserve assets, saw its surplus volume reduce from the previous year's US$34 billion to US$1.8 billion owing to banks' repayment of short-term borrowings and a slowdown of the rise in foreigners' securities investment.

As of the end of 2010, the foreign reserves amounted to US$291.6 billion, an increase of US$21.6 billion from the end of the previous year. Gross external liabilities increased by US$14.6 billion over the course of the year to US$360.0 billion, and external assets rose by US$37.6 billion to US$448.3 billion. As a result, net external assets, which represent gross external assets less gross external liabilities, expanded from US$65.3 billion at the end of the previous year to US$88.3 billion. Meanwhile, the ratio of gross external liabilities to nominal GDP (dollar basis) fell from 41.4% at the end of the previous year to 35.5%.

Figure 4
Exports/Imports and Current Account

(100 million U.S. dollars)   (100 million U.S, dollars)
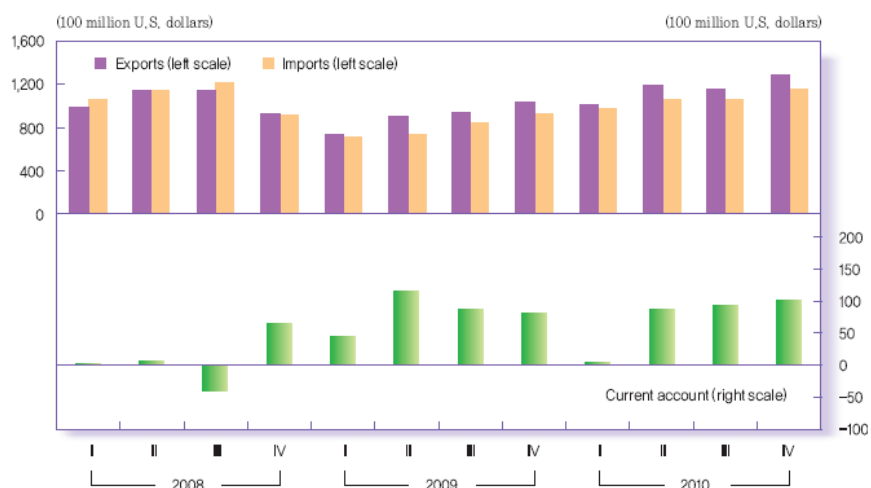
Source : BOK, Korea Customs Service.

5.1.4 Interest Rate and Exchange Rate:
Long-term Interest Rates and the Exchange Rate Fall, Stock
Prices Rise

In the financial markets, long-term interest rates and the won-dollar exchange rate fell under the influence of inflow of foreigners' investment funds, and stock prices rose sharply. Short-term market interest rates in general kept a similar level to the end of 2009. Long-term market interest rates showed a declining trend during the year, affected by a change in expectations of a hike in the Base Rate and also by inflows of foreigners' bond investment funds. They rose temporarily in May and June owing to fiscal problems in the Eurozone and North Korea-related risks. In December, they rebounded under the influence of regulations to reduce the volatility of inflows and outflows of foreign capital and growing inflationary pressure. Yields on Treasury bonds with a three-year maturity stood at 3.38% at the end of 2010, off 1.03 percentage points from the end of the previous year. The corporate bond risk premium (secondary market yields on AA-grade three-year corporate bonds versus those on three-year Treasury bonds) dropped by 0.23 percentage points from the end of the previous year to stand at 0.89 percentage points.

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Short-term market interest rates fell in the first half, but rose again in the latter half in response to the Bank of Korea's hike of its Base Rate. Secondary market yields on 91-day CDs fell by 0.06 percentage points from the end of the previous year to mark 2.80%. Banks' deposit rates showed a similar movement to short-term market interest rates, but their lending rates continued at a low level in the latter half as they engaged in campaigns to expand their loan books.

The KOSPI rebounded strongly, but the KOSDAQ index remained at the level of the end of the previous year. KOSPI fell sharply for a brief period owing to China's strengthening of liquidity management early in the year and the fiscal problem in the Eurozone in May. During the year, however, it maintained bullish movements under the influence of favourable business performances and inflows of foreigners' stock investment funds. KOSPI stood at 2,051.0 at the end of 2010, 368.2 points higher than at the end of the previous year. The KOSDAQ index stood at 510.7 at the year-end, 2.9 points lower than at the end of the previous year.

Figure 5
Market Interest Rates and Stock Prices
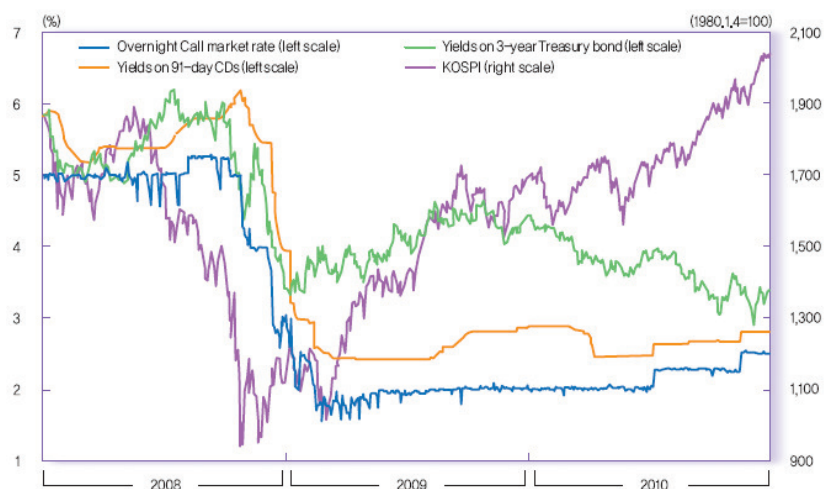
Source : BOK ECOS.

The won/dollar exchange rate showed similar movements with long-term market interest rates and stock prices, soaring to the year's record high of 1,253.3 won per dollar in May 2010 owing to outflow of foreigners' investment funds.

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Since then, it had witnessed a declining trend until October 2010, reflecting weakened global dollar following the U.S. additional quantitative easing. After November, it bounced back under the impact of regulations on macro-prudential and North Korea-related risk, posting 1,134.8 won per dollar at the end of 2010. The Korean won appreciated by 2.6% against the U.S. dollar from the end of the previous year and represented an appreciation of 10.4% on an annualised average basis.

5.2 Potential Risks in the Viewpoint of Financial Stability

### 5.2.1 Volatility of Foreign Capital Flows

Global liquidity has increased due to the quantitative easing policies in the major developed countries in the wake of the recent global financial crisis. Much of this abundant liquidity has flowed steadily into the emerging markets with relatively healthy fiscal positions and economies growing at solid rates. Despite the increasing world economic uncertainties in 2011, the inflow of global bond investment funds to the emerging markets has continued. The emerging economies' stock markets have on the other hand experienced alternating periods of capital inflows and outflows, meaning a more noticeable trend of discrimination depending upon the type of investment assets. In the Korean securities markets, despite the exit of funds from the stock market, foreign investment in Korean securities maintained a net inflow of US$4.6 billion in the year to September 2011, thanks to a sharp increase in capital inflows to the domestic bond market.

Regarding investment capital flows into the Korean stock market, after continuing to record net inflows in 2010, foreign investors shifted back and forth between net buying and net selling in 2011, in line with movements in the global stock markets and their changing appetites for risky assets.

Figure 6
Net Inflows of Global Security Investment Capital to Emerging Market Countries
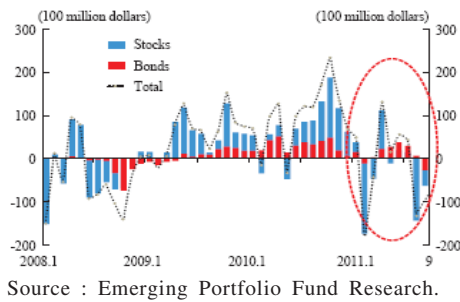
Figure 7
Foreign Investor's Korean Stock Net Purchase and Holdings

Source : Emerging Portfolio Fund Research.

Source : Bank of Korea.
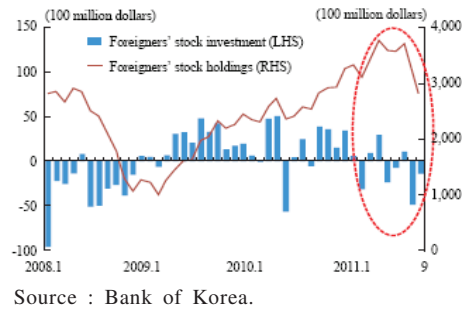
On the other hand, foreign investors have maintained a continuous net buying position in the Korean bond market since January 2011. Local bond holdings of foreign investors as a result totaled US$75.6 billion at end-September 2011, with their share in the total domestic bond market rising to 6.9% as of end- September from 6.6% at end-2010.

Figure 8
Foreigner Net Buying and Holding of Korean Bonds

Source : Bank of Korea.

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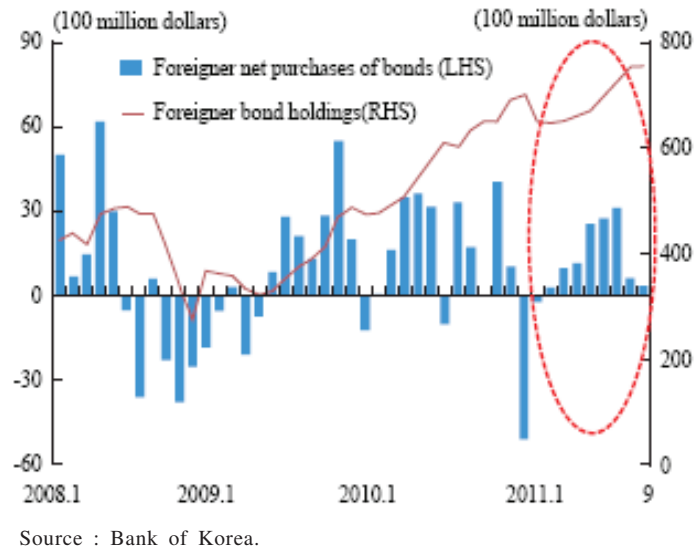
5.2.1.1 Possibility of Foreigner Securities Investment Fund Withdrawal

There is a possibility of foreign securities investment in the Korean markets shifting to net fund outflows, given the likelihood of international financial market instability persisting due to worries about the deepening of the European sovereign debt crisis. In particular, if the sovereign debt crisis spreads to the European banks, prompting their deleveraging, or if US economic growth slows, the possibility cannot be excluded of a massive exodus of foreign securities investment funds from Korea. Meanwhile, although foreign bond investment funds invested in the domestic market remain stable in normal times, they can also flow out on a massive scale in times of crisis, worsening financial system destabilisation[3]. Over the 19-month period after the Lehman Brothers bankruptcy filing, for instance, nearly 23% of the total foreign investment funds invested in local stocks left the country. For bonds, 22% of the foreign investment funds that had flowed in on a net basis before the Lehman crisis fled Korea intensively over just a four-month period following outbreak of the crisis.

<table>
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Figure 9
Ratios to GDP of Net Capital Inflows to Major Emerging Market Securities[1]

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Figure 10
Pre- and Post-crisis Foreigner Net Buying of Korean Securities

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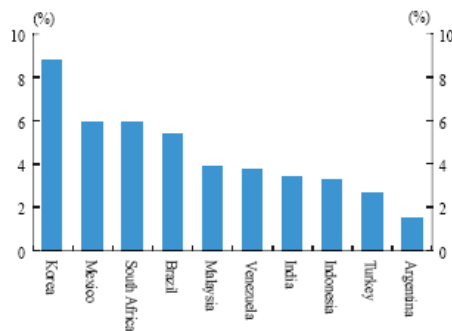
Note: 1) From Q2 2009 through Q4 2010
Source : ECB Financial Stability Review (June 2011).
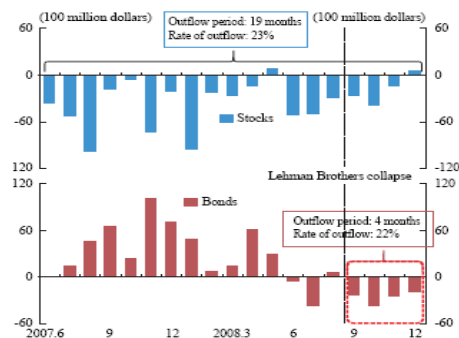
Source : Bank of Korea.

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3. During a crisis, a massive exodus of investment capital from the bond market can lead to a sudden hike in interest rates. In such a situation, the central bank is forced to intervene to bring interest rates down to a sustainable level, and foreign investors can, therefore, easily liquidate their bonds without significant losses. This appears to be one reason for the rapid outflows of foreign capital from the bond market in times of crisis.

5.2.1.2   *Possibility of Outflows of Banks' Foreign Currency Borrowings*

In the first half of 2011, banks' foreign currency borrowings, both short- and long-term, increased sharply from their levels in the second half of 2010. This appears to have been due chiefly to higher demand for short-term foreign currency borrowings on the one hand, owing to the increasing trade credits during the export upturn to support the real economy, and on the other hand to the sales[4] of off-shore NDFs under expectations of a stronger won. Because of the European sovereign debt crisis, loans from Europe have since August 2011 reverted to net outflows. Total foreign currency borrowing outflows are not significant so far, however, as foreign currency borrowing inflows from the US continue.

<table>
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Figure 11
Changes in Bank Short- and Long-term Foreign Currency Borrowings, and % of Short-term Borrowings

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Figure 12
Foreigner Holdings of Securities, and Foreign Borrowings

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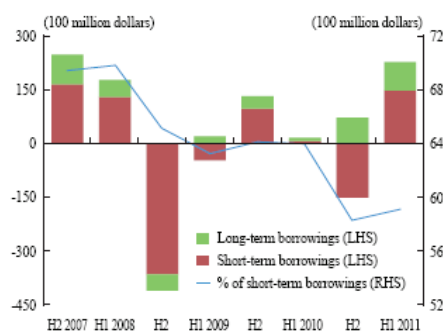
Note: 1) Short-term foreign currency debt/total foreign currency debt
Source : Bank of Korea.
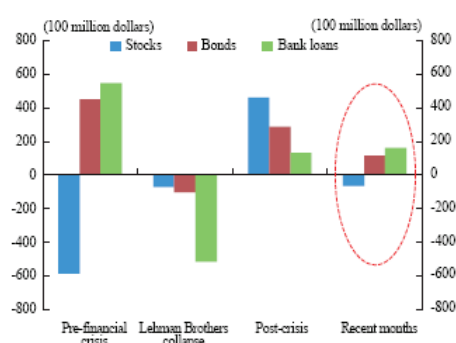
Source : Bank of Korea.

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4. A non-resident who expects the won to strengthen signs an agreement with a domestic bank to sell NDF's (Non-dleverable forwards) in the NDF. BY buyinh the NDF's, the bank becomes overbought, and in order to make its overall position (cash + forwards) square again and hedge its exchange rate risk, should sell cash positions equal to value of its overbought position. In this process, banks lacking sufficient US dollar liquidity must borrow from other financial institutions.

5.2.2 Debt Service Burdens of Vulnerable Household Sector

5.2.2.1 Household Debt Increase Continues

Household debt (based on the new household credit statistics) had increased to 876.3 trillion won as of end-June 2011, up 3.5% over the end of 2010. It continued on an upward trend in the second half of 2011 as well, despite both the government's efforts to restrain the increase in household lending and the housing market slump.

The increase in household borrowing for purposes of securing living expenses is attributable to the deterioration in household balances of payments (household expenditure-to-income ratios) due to the soaring living costs caused by rising lease deposit burdens and high inflation at a time when household incomes are not improving.

**Figure 13
Household Debt[1)
Outstanding and Rate
of Increase**
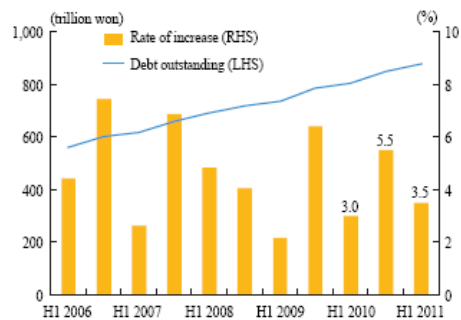
Note: 1) Based on household credit statistics (data prior to H2 2009 recalculated based on flow of funds statistics)
Source : Bank of Korea.

**Figure14
Household Expenditure-to-
Income Ratio, and Rate of
Lease Deposit Price Increase**
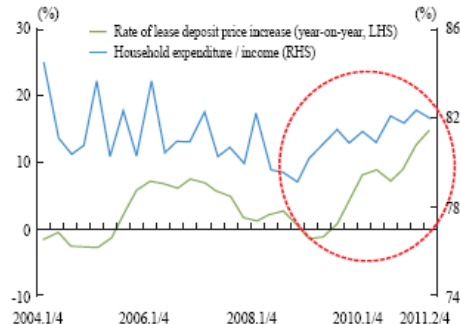
Source : Kookmin Bank, Statistics Korea.

5.2.2.2 Possibility of Rising Defaults Due to Vulnerable Household Groups' Repayment Burdens

The grace periods of mortgage loans extended since 2005 have begun to expire on a large scale, and the repayment of mortgage loan principal as well has gradually begun. The percentage of mortgage loans on which principal is being repaid had risen to 22.0% as of end-June 2011, a considerable increase from its figure of 17.7% at the end of last year. In line with the government's comprehensive measures to

curb household debt growth, banks are expected to be going forward expanding the proportions of their mortgage loans made without grace periods, which is likely to further increase households' principal repayment burdens.

Meanwhile, the analysis of delinquent mortgage loans whose grace periods have ended shows that, as of end-June 2011, about half (45.6%) of those delinquencies occurred within 10 months after the beginning of principal repayments[5]. These findings suggest that a sudden increase in borrowers' repayment burdens due to commencement of their principal repayments could lead to a rise in non-performing loans.

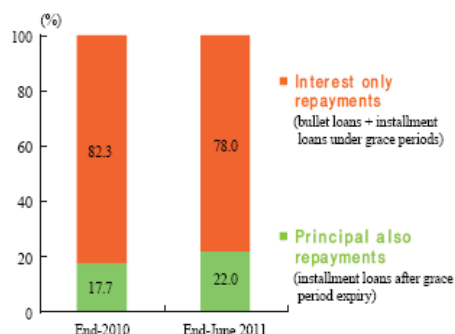'Home mortgage loans of vulnerable borrowers with low repayment capacities'[6], on which interest only is being repaid, meanwhile comprised 26.6% of a total of one million mortgage loans outstanding surveyed. Among these vulnerable loans, the proportions of loans whose collateral values were more than 600 million won and ones whose borrowers' annual incomes exceeded 40 million won accounted for 32% each of the total. Of these vulnerable loans, 34.8% are scheduled to mature between the second half of 2011 and 2012. Rates of maturity extension on banks' mortgage loans have declined in 2011, and banks' lending attitudes are growing increasingly conservative. This makes it likely that many of the vulnerable loans described above may go delinquent when they mature. In the event of an external shock in the form of a sharp house price drop or an interest rate hike, moreover, the resulting increase in principal repayment burdens may push these marginal borrowers into fire-sale disposals of their homes at low prices.

_____

5. Analysis of 1,051 delinquent bullet type loans whose maturities were reached between 2009 and the first half of 2011 shows over half of them (51.1%) to have become delinquent in the months when their maturities expired.

6. The term "home mortgage loans of vulnerable borrowers with low repayment capacities" refers to loans on which interest only is being repaid, with no repayment of principal and which also have higher risks of going into arrears because their sizes are excessive relative to either their borrowers' incomes or the collateral values of the homes concerned. The analysis on sorting these vulnerable loans in this paper was done, with and without income data, as follows: 1) Data with income information: only interest being paid, and loan balance-to-borrower income ratio eˆ 400%; 2) Data without income information: only interest being paid, and loan balance-to-collateral value eˆ 33% (for Gangnam, in Seoul), eˆ 40% (for Seoul except Gangnam), eˆ 49% (for metropolitan areas except Seoul), and eˆ 50% (for remaining local communities). (The threshold values of the loan balance-to-collateral value ratios were calculated using the medium values of those ratios after excluding the 30% upper and lower ranges of data listed as vulnerable loans in sector 1) above.)

Figure 15
Proportions[1] of Mortgage Loans, by Principal Repayment Type

Note: 1) Based on total loans outstanding
Source : Seoul metropolitan area home mortgage loan data of four major commercial banks.

Figure 16
'Home Mortgage Loans of Vulnerable Borrowers with Low Repayment Capacities', by Collateral Value[1] and Borrower Income[2]
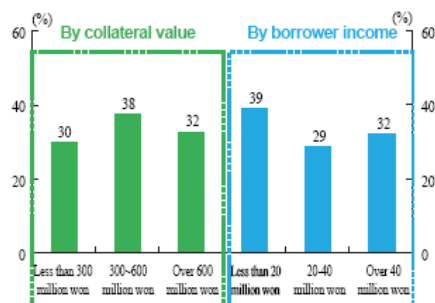
Notes: 1) Total amount of House mortgage loans of vulnerable borrowers with low repayment capacities' categorized by collateral value
2) Total amount of House mortgage loans of vulnerable borrowers with low repayment capacities' categorized by borrower income (based on data having income information only)
Source : Home mortgage loan data of four major commercial banks (end-June 2011).

5.2.3 Housing Price Volatility and Financial Institution Asset Soundness

5.2.3.1 Downward Prices Stabilised in the Seoul Metropolitan Area Amid Steady Rise Outside It

The housing markets in regions outside the Seoul metropolitan area are moving in a direction different from that in the Seoul metropolitan area. Since the 2nd quarter of 2009, prices of non-Seoul metropolitan area apartments, centering especially on five regional metropolitan cities, including Busan and Daejeon, have been rising sharply. Prices in the Seoul metropolitan area, on the other hand, have been on a moderate trend of decline since the 4th quarter of 2008.

Housing transactions are sluggish in the Seoul metropolitan area and lively in the other regions. In terms of monthly average trading volume, in the Seoul metropolitan

area, the apartment trading volume has since April 2011 remained below the monthly average during the previous 5-year period (of 34,000 houses, from 2006 through 2010). Outside the Seoul metropolitan area, on the other hand, the transaction volume has declined only slightly since April 2011, with the monthly average still exceeding the 44,000 house figure for the previous 5-year period.

Figure 17	Figure 18
Apartment Purchase Price Indices[1]	**Apartment Transaction Volumes[1]**
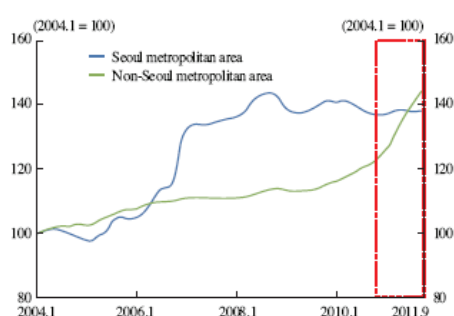
Note: 1) The index value for the non-capital areas is the simple average of the index values for the respective regions.
Source : Kookmin Bank.
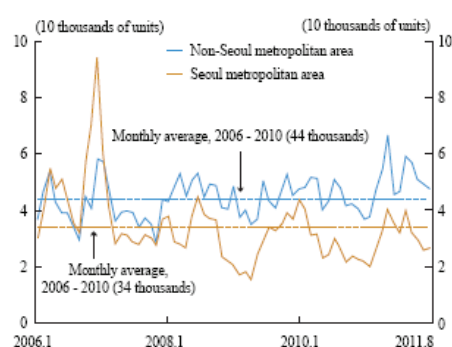
Note: 1) Data for the non-capital areas calculated by subtracting the capital area volume from the total volume nationwide
Source : Ministry of Land, Transport and Maritime Affairs.

6. Attempts to Strengthen Financial Stability Indicators

6.1 Macro-prudential Indicators: Why Macro-prudential Indicators Are Needed

Since the global financial crisis, the importance of monitoring financial systems and the necessity of tools to effectively measure and assess the possibility of systemic risk have increased. Concerns about the rising possibility of systemic risk have spread due to the diffusion of shocks among financial institutions and between the financial and the real sectors, and to the addition of the effects of procyclicality in the financial sector to those in the real sector. It is critical for the prevention of systemic risk to enhance the monitoring of the financial system, measure/assess the state of financial stability, and identify potential risk factors at an early stage.

International organisations including the IMF have tried to develop new indicators concerning financial stability or to strengthen the existing ones, as have several central banks. For example, the IMF developed its Financial Soundness Indicators in January

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2007 and its Financial Stress Index in April 2009, while Financial Stress Indices have also been compiled by the Bank of Canada (December 2008), the FRB-Kansas City (August 2009), the FRB-Saint Louis (January 2010), Sveriges Riksbank (June 2009), etc.

The BOK has also developed and compiled several indices, including a Financial Stress Index (March 2007) and a Financial Stability Map (December 2008). These indices have limits in evaluating overall financial stability conditions, however, since they focus only on specific areas, such as the financial market, or have high dependence on subjective inputs. Given these limitations of the BOK's micro-prudential indices, development is needed of new comprehensive indicators, which can capture the current status of financial stability and provide warning signals of potential systemic risks.

6.2 Financial Stability Index (FSIx)

One of the well known features of macroeconomic variables, especially financial time series data, is the existence of co-movements. It is easily found that some movements in a certain market lead to fluctuations of prices and volumes in other markets, and these fluctuations are in the end driven to a large extent by herding behaviour. And in these collective movements we can find one or several common components that can explain their principal trends. The BOK has focused on this point in its efforts to develop an indicator for financial stability.

The Financial Stability Index (FSIx) is the result of the BOK's efforts in this regard, and has the objective of measuring/assessing the domestic financial stability situation. This project has been promoted to meet the need for tools to measure/assess financial stability and the possibility of systemic risks. The FSIx includes six sectors and 64 variables. These variables have been selected based upon the results of a broad literature survey and the responses to a professional survey of financial and economic experts. The 64 variables are classified as 35 core indices and 29 additional ones, depending upon the degrees of importance of their monitoring:

Table 17
Constitution of FSIx

	Banks	Financial market	Real Sector	External Sector	Businesses	Households	Total
Total	19	10	15	6	7	8	64
Core	12	4	6	4	4	5	35
Encouraged	7	6	8	2	3	3	29

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The FSIx has been calculated from the standardised values of the observations made. This process makes it possible to compare/evaluate financial conditions in different sectors. Analysis on the pilot compilation of the FSIx reveals that the index performs satisfactorily in capturing financial instability. It shows a high level during the occurrences of major financial crisis and rises sharply at around the times of such events:

Figure 19
FSIx by Sector
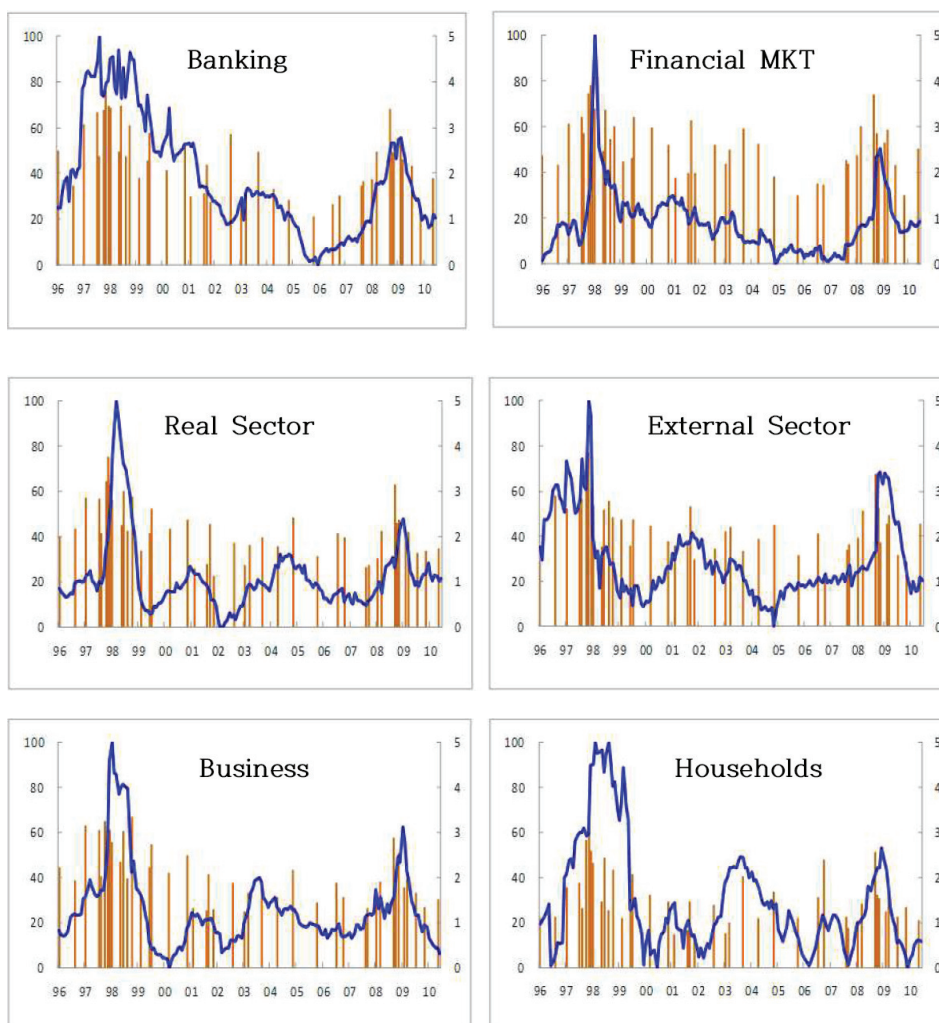
* The vertical lines show the degrees of financial instability obtained from the professional survey.
** FSIx for financial market used as financial stress index
Source: Bank of Korea.

Analysis of the durations and levels of risk using the FSIx shows the 1998 Asian crisis, the 2003 domestic credit card crisis and the 2008 global financial crisis to be major events for all sectors. The durations and levels differ across sectors, however. For the Asian crisis all sectors show high levels and long durations of risk. For the domestic credit card crisis, they exhibit relatively low levels of risk and short durations. For the recent financial crisis, the responses of all sectors except the banking sector reveal situations of risk:

Figure 20
Sectoral FSIxs and Risk Intervals
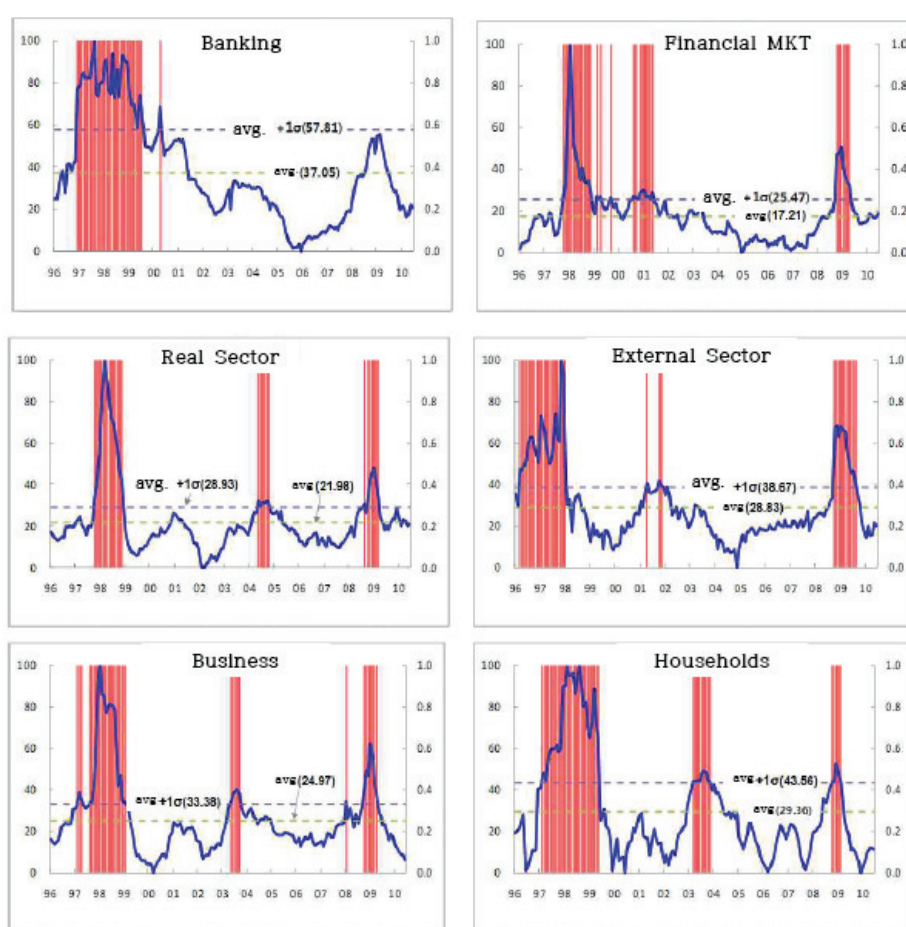
note : vertical shades express "risky interval" (over average+1.0 standard deviation) by index

Note : Vertical shades express "risky interval" (over average+1.0 standard deviation) by index.

A composite FSIx has been produced by consolidating the six sectoral FSIxs. It also shows relatively good compatibility to the real economy:

Figure 21
Composite and Sectoral FSIxs
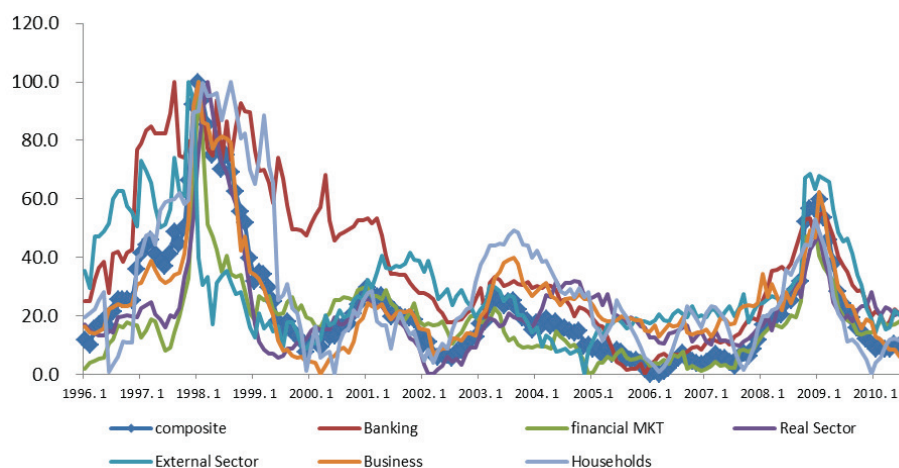
6.2 Systemic Leverage Ratio

The recent global financial crisis taught us that initial shocks of insignificant size, for instance from subprime mortgage loans, can evolve into full-blown financial crises if they amplify within the financial system. This lesson prompts us to seek a better understanding of the mechanism behind and factors that create systemic risk, and to develop macro-prudential policy measures to counter or mitigate this risk. It is therefore crucial to construct indicators that are able to identify incipient systemic risk and provide warning signals of crisis at an early stage.

Although it is hard to define systemic risk in a single way, broad agreement has emerged that procyclicality and interconnectedness are the main factors explaining it. Financial institutions build up excess leverage in the business cycle upswing, and supply excess liquidity to financial markets and excess credit to households and firms. And in the downturn they then reverse this trend by deleveraging through fire-sales and reducing their credit supply. This procyclical behaviour of financial institutions amplifies the financial and business cycles. Through interconnectedness, the other factor explaining systemic risk, shocks may meanwhile spread within the financial

system through the direct and indirect financial networks connecting financial institutions. Any well-functioning systemic risk indicator should therefore be able to capture these temporal and cross-sectional factors in systemic risk – procyclicality and interconnectedness.

Procyclicality in the financial system generally means the phenomenon whereby financial institutions' supply of credit, which expands during boom times and contracts during recessions, increases the business cycle amplitude. It is typical, especially in recessions, that fluctuations in the real sector induce instability in the financial sector and this financial instability then boosts the amplitude of the business cycle. Because of this procyclicality in financial institutions' leverage, it is important to capture in advance the risks of excessive credit expansion in boom times and contraction in recessions.

As another aspect of risk factors embedded in the financial system, interconnectedness also deserves mention. Due to the high interconnectedness among financial institutions, the financial sector is characterised by the fact that problems in a certain financial institution disperse to the financial markets as a whole. And these interactions have now deepened due to the increase in mutual lending, the development of derivatives, the greater dependence on non-deposit liabilities, etc.

The BOK is working to develop a systemic risk indicator that both signals early warnings and incorporates procyclicality and interconnectedness. In order that it satisfies the early warning criterion, the BOK will construct the indicator using balance sheet data. It is known that the build-up of excess leverage and subsequent deleveraging in the balance sheets of financial institutions are critical to systemic risk, and we may set a maximum threshold for leverage build-up during an upswing. Simple leverage cannot capture procyclicality and interconnectedness, however, and may hence underestimate systemic risk. It therefore needs adjustment with factors that capture 'hidden leverage,' and the BOK has in this regard come up with the novel concept of 'systemic leverage,' that incorporates this 'hidden leverage' into simple leverage. There are four components of hidden leverage—'mark-to-market leverage', 'interconnectedness leverage', 'off-balance sheet leverage' and 'FX leverage'. Financial institutions with mark-to-market profits and losses adjust their leverages, in the process of which their supply of credit fluctuates. Market financing leads to increase interconnectedness among financial institutions throughout the financial markets, so that external shocks are amplified within the financial system through contagion. Derivative contracts which are hidden in the off-balance sheet accounts have embedded leverage, and compound the leveraging and deleveraging process. For emerging market economies, meanwhile, the surge and sudden reversal of FX borrowings is another key systemic risk factor.

Given these backgrounds, the BOK has constructed an indicator that can reflect systemic leverage as follows:

$$I_t = \log(L_t^{w_1 l_{1t} + w_2 l_{2t} + w_3 l_{3t}}) = (w_1 l_{1t} + w_2 l_{2t} + w_3 l_{3t})\log(L_t)$$

where, L_t : borrowing leverage, l_{1t} : off-balance sheet leverage,
l_{2t} : interconnectedness leverage, l_{3t} : FX leverage,
w_1, w_2, w_3 : adjusting coefficient

The results of empirical study applying the above indicator to Korean domestic banks for the period of January 2000 - December 2010 demonstrate the indicator to have an early warning function vis-a-vis systemic risk. The probability of recession is estimated with the financial business cycle, which is extracted from stock prices and exchange rates with a Markov switching model:

Figure 22
Systemic Leverage as an Early Warning Indicator
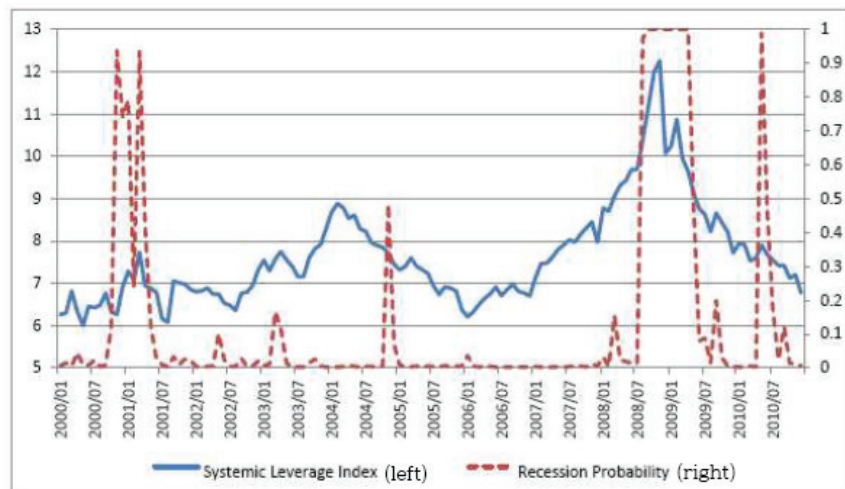
Source : Bank of Korea.

The figure above shows systemic leverage calculated using the monthly time-series data of all components of hidden leverage. In order to evaluate its capability to issue early warnings, we compare it with the business cycle that is expressed in blue line in the above graph. For more than one year prior to the global crisis we find systemic leverage above its 7.70 average for the period as whole, showing that it can effectively issue an early warning. In particular, if we look at the year-on-year trend of systemic leverage growth, it reaches 15% in January 2007 and remains at around 20% for about the next two years, far exceeding the average of 5.20% for the whole period. Its early warning capability hence becomes more clearly noticeable. Using the systemic leverage indicator we can identify the build-up of systemic risk above the set threshold, and implement macro-prudential policies to contain its further build-up.

6.3 Systemic Risk Survey

There are various ways of identifying potential risks. These approaches can be classified into two groups – quantitative and qualitative approaches. While objective data such as the prices and transaction volumes in a certain market are usually used in the former approach, subjective assessments can also be used in the latter approach.

Risk identification is important in the macro-prudential oversight process, because risks usually emerge in unexpected ways. To capture these risks effectively, it is necessary to collect opinions, especially those of market participants, from various aspects. And while the BOK already reports biannually one sort of qualitative index in its Financial Stability Report (FSR)[7], it is now conducting a pilot survey to develop a new way of identifying potential risks.

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7. Since April 2008, the BOK has reported a FSM (financial stability map) in its Financial Stability Report. The FSM has a hexagonal shape, and each sector comprising it is assessed for its degree of stability. The degree of stability of each sector is assessed by combining statistical quantitative methods which focus on the discretionary judgments of professionals:

Financial stability map[1]

— 2010.4~2010.9
— 2010.10~2011.3

Note: 1) The closer to the center, the more stable a sector is.
Source: Bank of Korea

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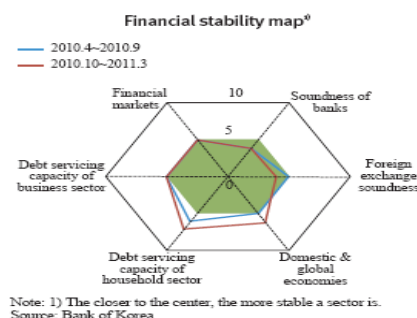
Macro-prudential Oversight Process

The survey items include (1) key sources of risks for the financial system as a whole, which are hard to handle for individual financial institutions; (2) the probabilities of high-impact events hitting the financial system in the short term (0~12 months) and the medium term (1~3 years); and (3) the degree of confidence in financial stability in Korea for the future. For the detailed survey items, refer to the "Systemic Risk Survey Questionnaire" provided in Appendix 1.

This survey targets 74 persons responsible for strategic management and risk management at their financial institutions including banks, securities companies, asset management companies, futures investment companies, card companies and insurance companies, as well as fund managers and dealers in the financial markets. The survey is carried out every six months. The questionnaire is sent to the targeted people in advance by mail or email, and surveyors then visit them to conduct interviews after confirming receipt of the questionnaire.

7. Policy Recommendations and Conclusions

It is a generally accepted idea that the upswing in financial cycle in the boom time accompanying rising asset prices, including real estate, has been fueled by credit expansion. That is, credit expansion is one of the major background factors of financial crisis. Affluent liquidity combined with low yield rate, makes investors and financial institutions assess risks to be comparatively low and induces increased leverage and risky behaviour in maximising their earnings. As a result, risk asset proportion in financial institutions balance sheet increases and it has been hedged with off-balance sheet transactions such as derivatives. Which make it harder to estimate the effects from an adverse shock on the economy due to uncertainty by the increased complicatedness in the financial transactions. This situation requires the central bankers who are responsible for the macro-prudential policy, to take interest in developing financial stability indicator reflecting the trend of liquidity or credit.

Capacity building is also needed for handling unexpected events like the recent financial crisis effectively and for responding to other economic turmoil in the future. For the central bankers who are in charge of important economic objectives including

price and financial stability, it is necessary for them to have outstanding analytical skills and cogitative ability to respond appropriately to the various economic challenges.

As we have seen in the recent financial crisis, it is hard for one central bank to deal with the transatlantic events. Due to the complicated interconnectedness among countries' economic and financial transactions, the contagion channel and velocity of an adverse event are beyond our imagination. Thus, it is recommended to share information and cooperate with neighbouring countries to develop effective and preemptive financial stability indicators.

The recent financial crisis has led to an emerging emphasis on the central bank's role in macro-prudential supervision in reducing the amplitude of the business and financial cycles to ensure financial stability and sound economic performance. For these objectives, it is important for the central bank to implement policies preemptively before the risks materialise. And it will facilitate the achievement of its policy objectives if the central bank is equipped with tools to perceive systemic risks and to measure their potential effects with some kind of early warning indicators.

Even though the necessity for such financial stability indicators is increasing, there has been limited progress in their development. This demonstrates the difficulties involved in the assessment of financial stability. The increased interconnectedness and deepened procyclicality due to the development of financial instruments and financial engineering techniques have made more difficult the identification of hidden factors triggering potential risks. And much greater efforts by central banks are required to supervise the stability of their financial systems.

In the midst of rapid financial innovations and changes, the development and strengthening of financial stability indicators is a fundamental step toward the ultimate goal of each central bank. In this paper, some of the BOK's efforts have been introduced, which might hopefully be of use as examples for other countries. Basically, they have been developed under the unique Korean background, and central banks of each country in SEACEN will of course wish elect their own unique and creative ways of fulfilling their new mandate, macro-prudential supervision, based upon their own historic, cultural, social and economic circumstances. This era of uncertainty and rapid change requires us, central bankers, to develop new macro-prudential insights in order to achieve our explicit and implicit mandates.

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Systemic Risk Survey Questionnaire

■ | **Key Sources of Risk to Korean Financial System** |

1.1 **Looking ahead, which risks do you believe will have the greatest impacts on   the Korean financial system, if they materialise? Please list these risks in the order of their potential impacts (i.e., that with the greatest impact first):**

_____

_____

1.2 **Among the risks in 1.1, which are the hardest to handle from the viewpoint of your institution? Please list these risks in the order of their importance (i.e. that of the greatest importance first):**

_____

_____

■ | **Aggregate Risks to Korean Financial System** |

2.1 **In your view, what are the probabilities of a high impact event in the Korean financial system in the periods ahead?**

	very high	high	medium	low	very low
In the short term (0~12 months)	☐	☐	☐	☐	☐
In the long term (1~3 years)	☐	☐	☐	☐	☐

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2.2 How has this probability changed over the past six months?

	increased	unchanged	decreased
In the short term (0~12 months)	☐	☐	☐
In the long term (1~3 years)	☐	☐	☐

2.3 How much confidence do you have in the stability of the Korean financial system as a whole over the next three years?

complete confidence	very confident	fairly confident	not very confident	no confidence
☐	☐	☐	☐	☐

2.4 How has your confidence changed over the past six months?

increased	unchanged	decreased
☐	☐	☐

This is the end of the survey. Please make any suggestions that you feel might help to enhance financial stability:

_____

_____

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Examples of Key Financial Risks

- Deepening European sovereign risk

- Sluggish US economic recovery

- Hard landing of Chinese economy

- Volatility in international currency values

- Rocketing raw material prices due to political instability in Middle East region,   abnormal climate change, etc.

- Increasing household debt

- Increasing default probability in SME loans

- Contraction in credit supply to SMEs

- Deteriorating soundness of non-bank financial corporations

- Expanding volatility of financial market price indexes, such as stock prices, interest rates, exchange rates, etc.

- Rapid foreign capital outflows due to uncertainty of internal and external economic conditions

- Deteriorating foreign currency funding conditions due to international financial market unrest

- Plunging of housing prices in metropolitan areas

- Soaring of housing prices in non-metropolitan areas

- Political, geopolitical risks due for example to elections, national security, etc.

Chapter 4

STRENGTHENING FINANCIAL STABILITY INDICATORS IN THE MIDST OF RAPID FINANCIAL INNOVATIONS: EVIDENCE FROM INDONESIA

By
Diana Yumanita[1]

1. Introduction

Over the last two decades, addressing financial stability has become an important subject of the national and international policy agendas. Moreover the financial instability appears to be increasing in most of the developed and developing countries. The continuing instability has pushed policymakers, particularly central bankers, to allocate increased resources to monitor the potential threats to financial stability and to elaborate a framework to achieve this goal. In the aftermath of the 2008 subprime crisis, the issue of systemic financial stability has become one of the authorities' major concerns.

High instability will fuel the crisis, including the economic crisis. Crisis not only affects incurs huge financial losses, but frequently the impact the whole economy as well. It is normally difficult to restore the stable economic conditions in a short duration.

However, there is as yet no widespread consensus in defining financial stability. Some authors define financial instability instead of stability, and others prefer to define the problem in terms of managing systemic risk rather than as maintaining financial stability. It is important to define appropriately the relevant concepts, especially what is meant by financial system, financial stability and instability, and systemic risk. Safeguarding financial stability is an important part of maintaining macroeconomic and monetary stability and is important for achieving sustainable growth. (Schinasi, 2007)

The monitoring of financial stability relies heavily on the existence of indicators that can be used as a basis for analysing the current health and stability of the financial system. These macro-prudential indicators comprise both the aggregated micro-prudential indicators of the health of individual financial institutions and the macroeconomic variables associated with financial system soundness. This paper assesses the financial stability indicators in Indonesia.

Following this introduction, Section 2 will provide a survey of the literature on financial stability. Section 3 will give a brief description of Indonesia's financial landscape and regulatory structure that is currently in place. Section 4 will describe Indonesia's approach in the strengthening of financial stability indicators, and in Section 5, an assessment of the country's approach will be made. Section 6 will give present the recommendations and policy implications, followed by the conclusion in Section 7.

2. Literature Study

2.1 Theories of Financial Instability

There is no broadly accepted definition on financial stability with regard to the indicators of good financial system, e.g., market stability, absence of shocks, low volatility and something more fundamental, like public sector contribution, in promoting financial system stability.

In short, financial stability means avoidance of financial crisis (MacFarlane, 1999; Sinclair, 2001). To be more specific, financial stability is institution and market stability which together make up financial stability (Crockett, 1997). Mishkin (1991) defined financial crisis as disturbance in a financial market where adverse selection and moral hazard are in a bad state impairing the financial market from making good its intermediary function of funding the most productive potential creditor. Schinasi (2004) defined financial stability as a condition where the financial sector retains its ability to facilitate and strengthen economic activities, manage risks and absorb shocks. From the above definitions, it is possible to conclude that financial system stability is aimed at creating stable institutions and markets to avoid financial crises.

There are three main reasons why financial stability is important. First, a stable financial system will create trust and a favourable environment for investors as well as safeguard small investors' interests. Second, it will promote an efficient financial intermediary function which ultimately will promote investment and

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economic growth. Thirdly, it will stimulate market allocation of resources in the economy.

Financial instability will create adverse consequences for the government budget in the form of increased fiscal expenses to help distressed financial institutions and may lead to currency and banking crises. A number of developments in recent years have put financial stability as the main agenda of central banks, monitoring bodies and governments. These developments include: (i) a significant growth in financial transactions; (ii) the growth of non-bank institutions offering a wide arrange of products and services; (iii) the complexity of banking activities; and (iv) government outlays incurred in reviving financial institutions. Besides, several fundamental changes, including changes in monetary policies and problems faced by the banking and real sector, have made financial stability management more difficult.

2.2 Indicators for Macro-prudential Surveillance

Researchers have developed a variety of economic theories to explain the soundness of financial markets. The development of financial indicators intensified since the Asian crisis of 1997 which is widely perceived as the trigger that prompted recognition of the need for a new financial stability data source. Davis (1998) claimed that financial instability - described as bank failures following loan or trading losses, market price volatility after a shift in expectation, or a collapse of market liquidity and issuance - had resulted in over 20 international financial crises between 1970-1998. It had been estimated that each crisis had cost around 15% of the impacted country's GDP. Hence, Davis argued the need for monitoring conjunctural and structural trends in the financial markets so as to give warnings of the approach of financial instability. Certain data such as flow of funds data, financial prices and monetary data, become important.

The earlier literature on aggregated micro-prudential indicators follows the categorisation of the CAMELS rating. These variables are less frequent than macroeconomic indicators for which higher frequency data are available. A classic study by Altman (1968) uses the so called z-score model, which is based on several financial ratios capturing asset quality, earnings performance, and liquidity, but this analysis is at the level of the individual firm.

More recent studies, particularly before year 2000, also focuses on the level of non-performing loan and inflation risks (Evans, et al., 2000). Gonzales (1999) showed empirical evidence that the CAMELS type assessment is statistically significant only if non-performing loans and capital adequacy are simultaneously

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considered. Lizondo and Reinhart (1998) are less able to explain currency crises than exchange rate misalignment. Many of these studies use logit/probit models to capture banking fragility. But their ability to detect future events in the out of sample forecasting context is limited. Hence, Gonzalez-Hermosillo (1999) combined both micro and macro factors in explaining banking fragility and concluded that the introduction of macroeconomic variables significantly improves the explanatory power of models based on micro-prudential indicators only.

3. Indonesia's Financial Landscape and Regulatory Structure

3.1 Indonesian Financial Landscape

The financial system in Indonesia consists of the major financial institutions and financial markets. The banking sector in Indonesia, which includes 121 commercial banks and 1,669 rural banks, dominates the financial system. As Figure 1 shows, the total assets of the banking sector reached 76.9% of total assets in the financial system as of end- December 2011, while the multi- finance company took up about 6.13%; insurance about 9.41% and other institutions such as pension funds, joint venture, securities companies, pawnshops and mutual funds, held only a very small portion of around 7.56%. Nevertheless, the important category of financial institutions within the banking system are the 14 banks with a market share of 69.8% of the banking sector assets. Among the top three banks is a state-owned bank with a market share of 33.9%.

Figure 1
Share of Financial Institutions (By Asset)
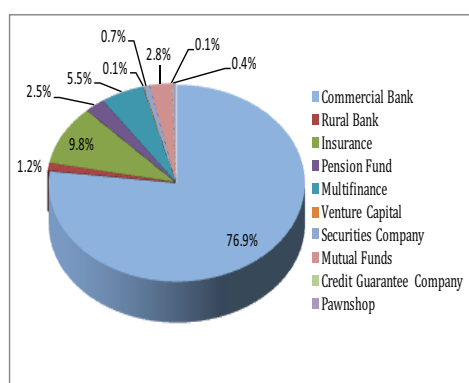
Figure 2
Number of Financial Institutions
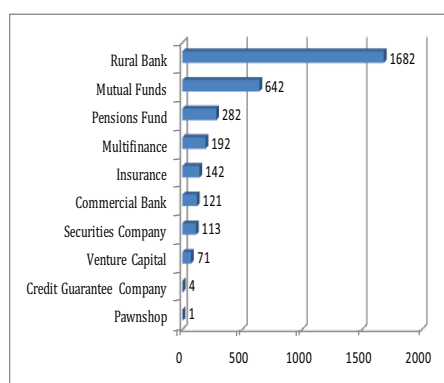
Source: Financial Stability Review, Bank Indonesia, 2011.

Furthermore, the composition of ownership in the Indonesian banking sector is dominated by private commercial banks. As Figure 3 shows, by the ownership, the Indonesian banking sector, which consists of 4 state banks, has assets totalling more than Rp 50 trillion. The rest of banking sector which comprise largely around 57 banks has between Rp 1 trillion up to Rp 10 trillion, dominated by foreign exchange commercial bank. Only 20 banks have assets more than Rp 50 trillion, and 30 banks have assets between Rp 10 trillion up to Rp 50 trillion.

Figure 3
Total of Commercial Banks Based on Total Assets
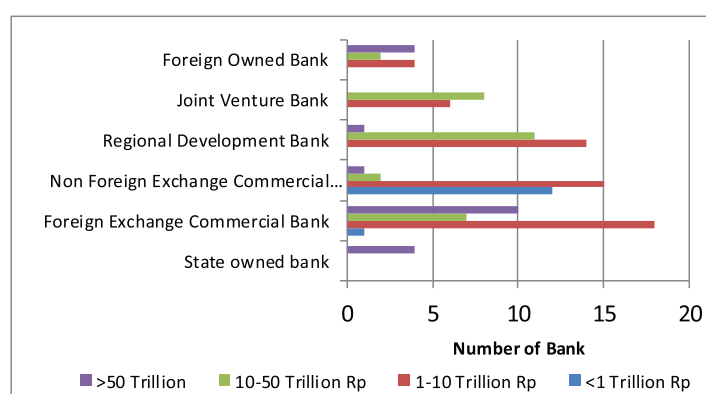
Source: Indonesian Banking Statistics, Bank Indonesia, 2011.

There is much potential growth especially for financing entities, mutual funds and pension funds in the non-bank sector. High automotive demand is believed to be an important factor in this growth trajectory. Hence, the contribution from non-bank institutions is expected to increase in the future in line with efforts taken by the government for financial deepening. However, the increase in non-bank sector activity certainly requires more intensive monitoring to avoid systemic risks as Indonesian banks also own these institutions wholly or partially.[2] As of December 2011, the main source of funding for multi-finance company was a bank with a portion up to 54.13%. This figure implied that, if something is to happen to the bank, the source of funding of multi-finance company will be

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2. For example, Bank Mandiri which is the biggest bank in Indonesia owns 51% share in AXA Insurance, 51% share in TUNAS Finance, while Bank Central Asia owns 99.58% share in PT. BCA Finance and 100% share in PT.Bank BCA Syariah.

disrupted. Similarly with the bank, although the multi-financing only makes up about 5% of total financing, it will still be a potential problem should the bank become a parent bank for a multi finance institution as this risk may add to financial instability.

3.2 Financial Regulatory Structure

The enactment of the Financial Service Authority (FSA) in October 2011 ushered a new start for Indonesian banking monitoring authority. Prior to this, the supervision of the financial sector was conducted by two institutions, namely Bank Indonesia and the Ministry of Finance. The supervision of the banking sector is conducted by Bank Indonesia, while the supervision of other financial sectors, including pension funds, insurance, multi finance, and securities companies, is performed by the ministry of finance. The enactment of the new Laws of Financial Service Authority implies that the new agency will take over the financial sector supervision either from Bank Indonesia and Ministry of Finance.

As practised in other countries, the Financial Services Authority is actually an independent body, which has responsibility to supervise the whole financial sector. The board of FSA commissioners consist of seven members, comprising a chairman, a deputy and five members each representing the banking, non-bank institutions, auditor intern, customer protection, and capital market segments. This board of commissioners will be assisted by two officials serving in their capacity as ex-officios from Bank Indonesia and Ministry of Finance.

Figure 4
Financial Regulatory Authority after FSA Act No. 21/2011

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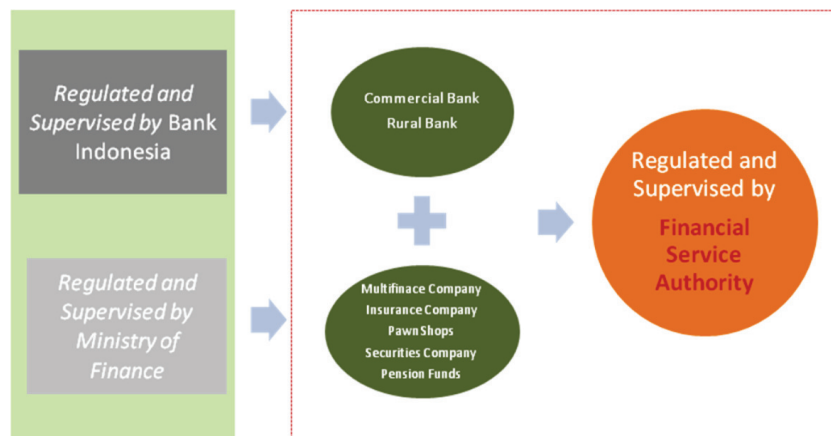
Article 6 of the above Law stipulates that the regulation and monitoring of financial services activity in banking, stock market, insurance, pension funds, financing and other financial institutions is the responsibility of the FSA. The scope of its work includes bank organisation, soundness, prudential aspects and inspection. In order to formalise the regulations related to capital adequacy, integrated banking information system, capital flows management and the selection of the so-called systemically important bank, Bank Indonesia should be involved.

However, within the new law, Bank Indonesia is still able to conduct direct inspection in the guise of Special Inspection with the written notification of the FSA. There will also be a Financial Stability Forum consisting of the Minister of Finance, Governor of Bank Indonesia, Chairman of the FSA and the Commissioner and Chairman of the Deposit Insurance Corporation. This forum will meet regularly and hold *ad hoc* meetings as and when the circumstance necessitates.

Figure 5
Coordination Mechanism of Financial Stability Forum
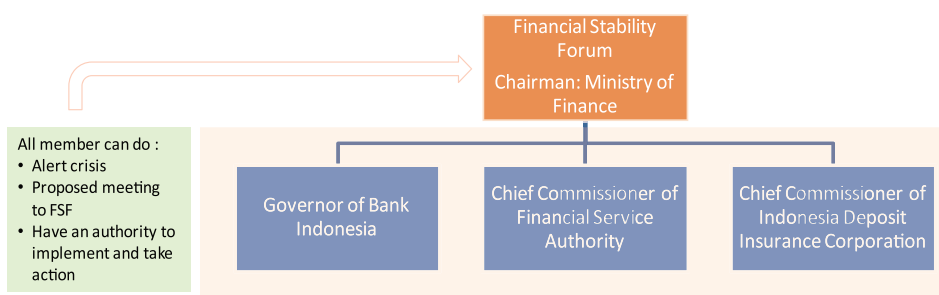
Source: Financial Authority Act 2011, modified by author.

The new law will be implemented with effect from 31 December 2012 transferring the regulation and monitoring of the stock market, insurance, pension funds, financing and other financial institutions to the FSA while, for banking, the transfer of authority will take place on 31 December 2013. Until then, the monitoring of financial system stability will be undertaken by Bank Indonesia along with the FSA.

4. Indonesia's Approach to the Strengthening of Financial Stability Indicators

4.1 Role of Bank Indonesia in Promoting Financial Stability

The monitoring of financial system stability has been done by Bank Indonesia since 2004 although this role is not explicitly provided in any formal law. It is unlike the other countries, such as Malaysia, UK, Japan, Thailand, Singapore and Australia, which have formalised the role of their central banks in financial system stability either in their vision and stated mission, or in formal law. Bank Indonesia undertakes the duty of preserving financial stability in conjunction with its other duties in maintaining price stability and exchange rate stability.

Financial stability assumed increased importance after the 1997 crisis. In line with the Central Bank Law No.23/1999, Bank Indonesia included financial stability in its mission "to reach and maintain Rupiah exchange rate stability and the development of financial stability for a sustained national growth." For the implementation of the financial stability function, Bank Indonesia refers to a framework that includes goals, strategy and tools of financial stability.

There are four strategies Bank Indonesia uses to maintain financial stability. They are:

1) Regulation and prudential monitoring that considers market discipline consistently.
2) Research and surveillance that includes valuation, assesment and monitoring of related aspects that threaten financial stability utilising an early warning system of micro and macro indicators.
3) Crisis management related to safety net mechanism within a crisis resolution framework. The formulation of policy and procedures for crisis management is in progress.
4) Encourage coordination with other related authorities; government, monitoring authority and Deposit Insurance Corporation, especially with regard to crisis prevention and management.

Figure 6
Financial Stability Framework
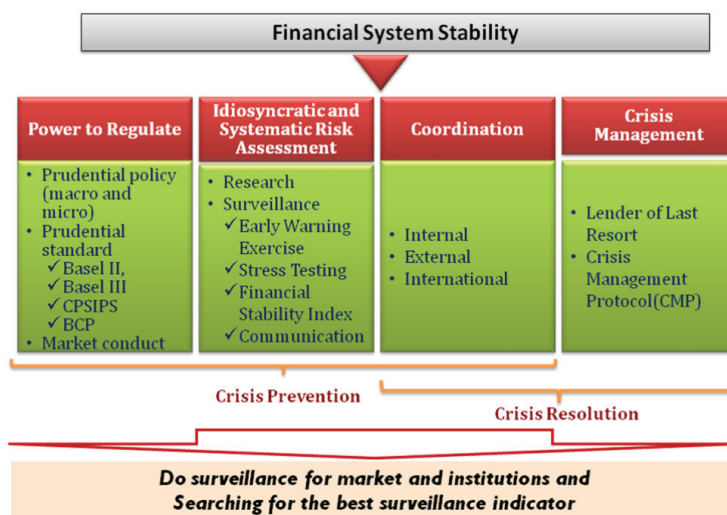
Source: Bank Indonesia.

Figure 7
Link between Financial System Stability and Monetary Stability
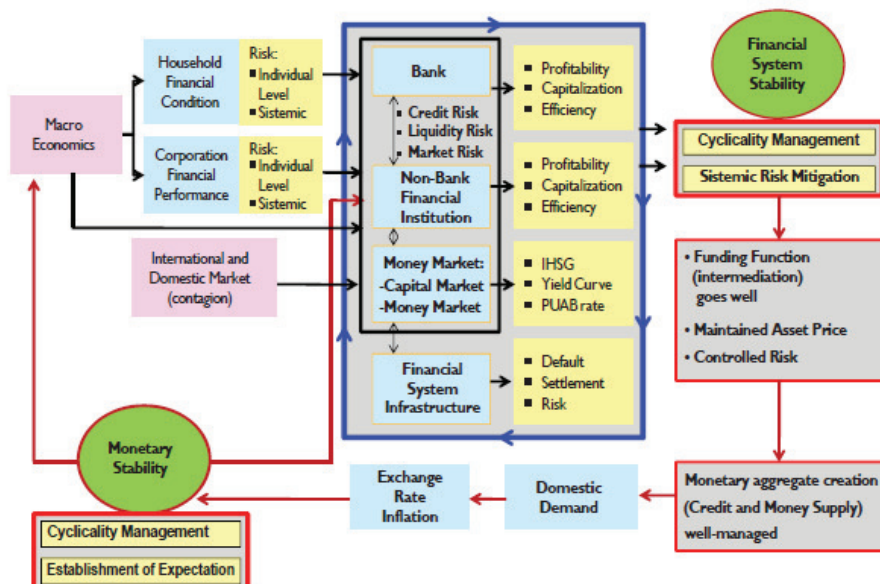
Source: Bank Indonesia.

4.2 Indonesia's Approach to Strengthening Financial Stability Indicator

Monitoring financial stability mainly involves measuring potential risks and systemic risks that may lead to crises. Early detection of such risks will help central banks and governments to take the necessary action needed to avoid such crises. Bank Indonesia uses leading macro indicators and other stability indicators as part of an Early Warning System (EWS) to monitor financial stability. Early warning data is reported regularly to the Board of Governors and published in the weekly and fortnightly financial stability report.

At the aggregate level, a major tool used by Bank Indonesia to assess financial system stability is the Financial Stability Index (FSI). During 2011, Indonesian financial stability was well preserved. The FSI recorded 1.63 in December 2011, slightly worse than the June 2011 figure of 1.65. A robust banking sector and an easing of pressure in the stock market combined to uphold stability in the financial system. The robust economic conditions together with domestic financial stability in the midst of global uncertainty was recognised by Moody's and Fitch which resulted in an upgrading of Indonesia's rating to investment grade.

Figure 8
Financial Stability Index
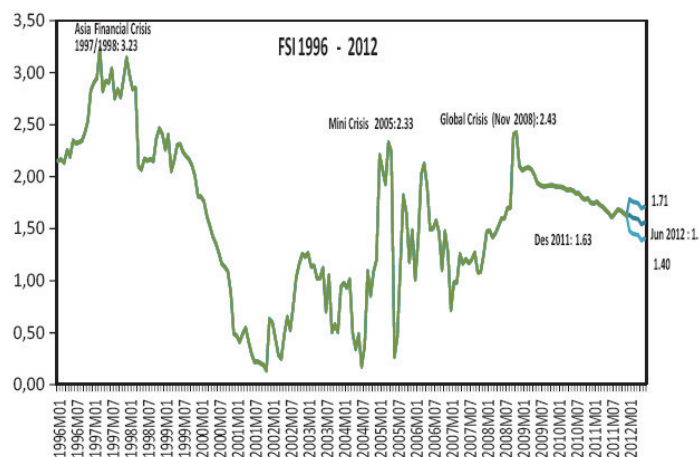
Source: Financial Stability Review, Bank Indonesia, 2012.

Apart from the stability index, Bank Indonesia also conducts stress testing periodically[3] and surveys. As a part of its macro-prudential surveillance, Bank Indonesia has also conducted regular stress test as we can see in Table 1.

Table 1
Stress Testing

No	Stress Test	Description	Objective
1.	Macro Credit Risk Stress Testing	Shock on macroeconomic variables to bank's credit risk	• To assess the effect of macroeconomic shocks on bank credit quality (NPL gross ratio). • The macroeconomic variables include real GDP growth, real policy interest rate, and real effective exchange rate. • The dynamic panel model is estimated using the Fixed Effect Least Square method. Among the three key macro variables, GDP contributes the most to banks' credit risk.
2.	Credit Risk Stress Testing	Shock non-performing loans to capital	• To assess the impact of the changes in credit quality to bank capital adequacy ratio (CAR). • The results of the macro-credit risk (NPL gross ratio scenarios) used as an input in credit risk stress test. • When the provisions are insufficient, bank capital will be used directly to absorb losses. Hence, an increase in NPL will put pressures on bank capital (CAR).
3.	Interest Rate Risk Stress Testing	Shock in market rates to capital	• To identify the impact of interest rate changes on a bank's portfolio of assets and liabilities, and on capital (CAR). • There are two simulations conducted, namely, interest rate increase and decrease.

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3. For more details on stress testing carried out by Bank Indonesia, see Gunadi, Iman, et al., (2011), "Addressing Risks in Promoting Financial Stability: Indonesia Experience," The SEACEN Centre.

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			• Each interest rate change scenario is multiplied by bank exposure based on bank's net long/short short-term positions.
4.	Exchange Rate Risk Stress Testing	High depreciation of ER to capital	• To identify the effect of the depreciation/appreciation of IDR on bank portfolio in foreign currencies and its impacts on bank capital. • The impact of direct exchange rate risk is analysed using the Net Open Position (NOP). The changes in CAR is equal to the exchange rate shock times the exposure
5.	Government Bond's Stress Testing	Shock on bond prices to capital	• To assess the impact of the decrease in price of Surat Utang Negara (SUN) or government bond on bank capital (CAR).
6.	Liquidity Risk Stress Testing	Shock on liquid assets to capital	• To assess the impacts of liquidity shortage encountered by banks on their capital (CAR). • Liquidity shortage is calculated by subtracting the amount of banks' liquid instruments from their current liabilities. Bank's liquidity shortage will be covered by the Interbank Money Market (PUAB) where the cost is based on the highest PUAB interest rate.
7.	Integrated Stress Testing	Credit, interest and market risks assessment	• To assess the impact of integrated shock causes by changes in NPL, interest rate, exchange rates and government bond's price, are examined simultaneously to identify their total impacts on bank CAR
8.	Interbank Stress Testing	It estimates the number of banks that will have CAR less than 8% (solvency problem) following a bankdefault	• To assess bank resilience to a shock where the capital loss of the lending banks due to the default of a particular bank (unable to repay its inter-bank obligation) is estimated

* More detailed information can be seen in "Addressing Risks in Promoting Financial Stability" by Gunadi, et.al. (SEACEN, 2011).

At the individual institution level, micro-prudential indicators are used for monitoring credit risk, market risk, liquidity risk, and systemic risk with a view to preventing contagion which may affect the financial system, corporates and households.

In assessing risks to the financial system, Bank Indonesia also monitors macroeconomic indicators to measure financial stability. Micro-prudential and macroeconomic indicators complement each other. Micro-prudential indicators are useful to measure conditions in individual financial institutions with regard to the potential credit risk, liquidity risk, market risk and profitability of financial institutions, while macroeconomic indicators can point to risks emanating from the domestic and global economy for these entities These macroeconomic and micro-banking indicators then are used to analyse and to predict financial system stability. A summary of indicators used for macro-prudential surveillance by the Bank of Indonesia is given in Figure 7.[4]

Figure 9
Indicators for Macro-prudential Surveillance

Source: Bank Indonesia.

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4. Some macro-prudential indicators have already been published (SEACEN, 2011).

Table 2
Key Financial Soundness Indicator

Institutions	2006	2007	2008	2009	2010	Q3 2011
Banking System						
Regulatory capital to risk-weighted assets (%)	18.79	20.20	16.84	18.21	16.97	16.64
Regulatory Tier 1 Capital to risk-weighted assets	14.58	16.83	14.73	15.95	15.10	14.99
Non-Performing Loans net of provisions of Capital (%)	44.61	26.37	23.58	21.91	17.66	17.55
Non-Performing Loans to total gross loans (%)	7.34	4.85	3.89	3.88	2.94	3.00
Sectoral distribution of loans to total loans (%)						
Agriculture	5.70	5.68	5.14	5.38	5.15	4.88
Mining	1.78	2.62	2.46	2.98	3.48	3.79
Manufacture	23.23	20.52	20.74	17.21	15.60	15.63
Electricity	0.91	0.79	1.41	1.71	1.93	2.60
Construction	4.18	4.40	4.49	4.47	3.60	3.60
Trade	20.63	21.64	19.85	20.96	19.23	18.25
Transportation	3.42	3.67	4.79	5.09	4.26	4.19
Service	9.90	10.95	11.65	10.49	10.16	10.44
Social	1.52	1.39	1.20	1.18	2.50	2.64
Others	28.74	28.34	28.26	30.52	34.09	33.97
Return On Assets (%)	2.63	2.78	2.34	2.61	2.74	3.11
Return On Equity (%)	67.77	56.01	58.73	58.96	61.40	50.98
Interest margin to gross income (%)	39.10	43.89	43.11	43.35	42.69	45.61
Liquid Assets to total assert (Liquid Assets Ratio) (%)	21.98	23.04	16.44	17.90	21.39	20.61
Insurance Company						
Market Structure						
Number of registered insurer	157	149	144	144	141	na
Insurance and reinsurance broker	166	169	162	164	157	na
Loss adjusters	33	27	27	28	27	na
Actuarial consultants	30	30	28	29	28	na
Insurance development						
Total industry asset (Trillion Rp)	174	228	243	320	405	na
as % of GDP	7.79	12.61	15.45	18.45	20.37	na
Corporate Sector						
Return on asset						
Agriculture Sector	-	-	-	-	8.8%	-
Mining Sector	-	-	-	-	7.1%	-
Basic Industry Sector	-	-	-	-	7.2%	-
Miscellaneous Sector	-	-	-	-	10.1%	-
Consumption Sector	-	-	-	-	14.3%	-
Property Sector	-	-	-	-	3.5%	-
Infrastructure Sector	-	-	-	-	7.9%	-
Trading Sector	-	-	-	-	3.4%	-
Return on equity						
Agriculture Sector	-	-	-	-	16.4%	-
Mining Sector	-	-	-	-	16.5%	-
Basic Industry Sector	-	-	-	-	3.0%	-
Miscellaneous Sector	-	-	-	-	28.3%	-
Consumption Sector	-	-	-	-	27.2%	-
Property Sector	-	-	-	-	7.3%	-
Infrastructure Sector	-	-	-	-	20.1%	-
Trading Sector	-	-	-	-	6.7%	-
Debt to equity ratio						
Agriculture Sector	-	-	-	-	84.6%	-
Mining Sector	-	-	-	-	126.7%	-
Basic Industry Sector	-	-	-	-	21.8%	-
Miscellaneous Sector	-	-	-	-	164.1%	-
Consumption Sector	-	-	-	-	79.6%	-
Property Sector	-	-	-	-	92.1%	-
Infrastructure Sector	-	-	-	-	140.3%	-
Trading Sector	-	-	-	-	94.9%	-
Household Sector						
HH Debt to total asset	-	-	-	-	4.0%	-
HH Short term debt to liquid asset	-	-	-	-	22.0%	-
HH Debt to fixed asset	-	-	-	-	2.7%	-

Notes:
1. Banking sector: from banking statistic report.
2. Insurance sector: Bapepam LK.
3. Corporate sector: from annual report from various public company.
4. Household : Households Survey conducted since 2010.

Given the predominance of the banking sector in the financial system, risk in the banking sector has an important impact on financial stability as a whole. Therefore, surveillance in micro- prudential indicator focuses on the banking sector. Nevertheless, the non-banking sector shows increasing asset and activities, hence the interconnection between financial institutions will be concerned to keep the systemic risk.

Surveillance is important in order to anticipate the development of risks to the financial system either from domestic or global sources. The detailed monitoring of bank's capital, credit risks, market risks and profitability is needed to recommend suitable policies for managing financial stability.

Figure 10
Core Set: Capital Adequacy
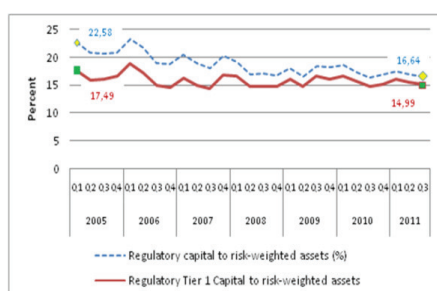
Source : Bank Indonesia.

Figure 11
Capital, the Minimum Statutory Reserve and Bank CAR
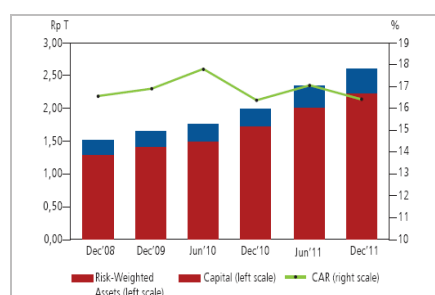
Source : Financial Stability Review, Bank Indonesia.

Since the last three years, the tendency of banking capital adequacy is to decrease. On December 2011, the CAR dropped to 16.82 % compared 18% compared to June 2010. Nevertheless, this number is still relatively high in relation to the minimum capital stipulated in Basel II. The low level of CAR at the second semester of 2011 was primarily caused by a hike in the minimum statutory reserve that exceeded the average increase in capital. The average minimum statutory reserve for banks increased by Rp244.59 trillion or 11.46% while average capital only increased by Rp25.97 trillion or 6.94%.

Along with the recovery of the Indonesian economy, the credit growth continues to grow up to 26-27% a year. Consumption sector maintain the highest growth compared to sectors such as trade and service and other sectors. However, while credit growth is still increasing, the asset quality that represented by the non-performing loan indicator tends to decrease since 2006.

Figure 12
Core Set: Asset Quality
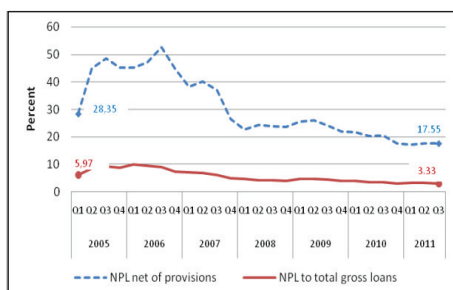
Figure 13
Distribution of Credit by Sector
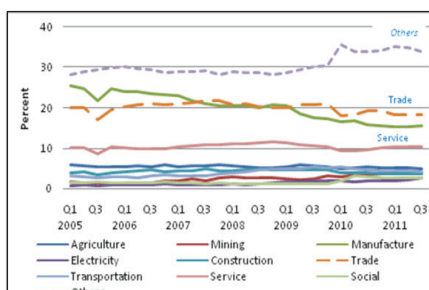
Figure 14
Earnings and Profitability
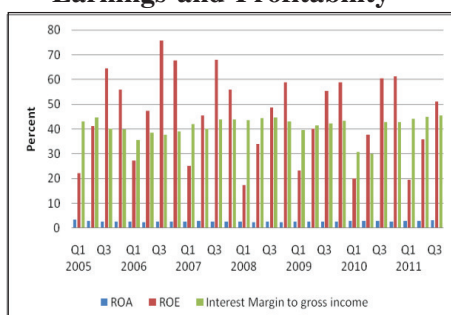
Figure 15
Liquidity
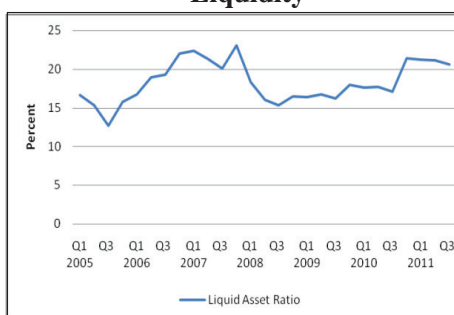
4.3 Specification of Macroeconomic/Market Variables

During 2011, Indonesia showed a promising performance with growth of 6.5%, with inflation kept as low as 4.6% and exchange rate and financial system stability maintained at desired levels. Elsewhere, economies faced a tremendous strain from crisis, huge public debt, budget deficit and high unemployment. These problems in the European countries, together with slow growth in the developed countries such as Japan, US and China, have all their contributed towards slow global economic growth which recorded only 1.2% in 2011.

The protracted crisis in Europe impacted on global financial sector volatility, causing tight liquidity and increasing risks in the global financial markets. Besides that, the credit rating decline in the European countries also triggered negative sentiments. The sheer weight of all these was clearly felt in Indonesia. There was a significant surge of capital flows at the end of the third quarter of 2011, reaching Rp 21.93 trillion as a result of Bank Indonesia Certificate (SBI) and

Government Bond (SBN) and net foreign transaction in the stock market. However, capital flows especially to government bond and Islamic Government Bond (SUKUK) (US$0.9 billion in November 2011) is expected to give a better investment grade for Indonesia.[5]

The aforementioned financial market conditions are sure to have their own risks towards the Indonesian economy. From the banking side, securities held by banks, net trading with other banks, accepted bills, bank guarantee and irrevocable LC will have foreign exposure as a result of the surge of capital flows. However, direct foreign exposure share is relatively insignificant with only 3.56% out of total Indonesian banking assets.

Nonetheless, the stability of the financial system remains promising followed by improved intermediary function as reflected by credit growth at 26% in November 2011 (y-o-y) and with investment credit, working capital, and consumtion growth at 36% (y-o-y), 22.2% (y-o-y) and 26%, respectively. With respect to the financial stability, the Indonesian banking sector has been stable, reflecting in a high Capital Adequacy Ratio (CAR) of well above 8% and a gross non- performing loan (NPL) ratio of below 5%.

However, as long as Greece and the US struggle for economic recovery, Indonesia will encounter more capital flows. This surge means that there is potential for outflows as well. Anticipative efforts are becoming increasingly obvious to deny reversal in the Indonesian economy. During the second semester of 2011, outflows reached as high as US$5.4 billion even though in 2012 the net position of foreign capital flows is positive at US$14 billion. This condition, if not addressed, will increase market risks, weaken the exchange rate and increase foreign currency volatility.

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5. Finally, FITCH Rating and Moody's Investor gave the investment grade for Indonesia in December 2011, from Ba1 rating to Baa3 rating.

Figure 16	Figure 17
Balance of Payment Indonesia	**Exchange Rate Volatility**
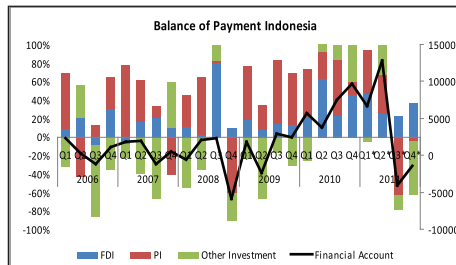
Source : Indonesian Financial Statistics, Bank Indonesia.
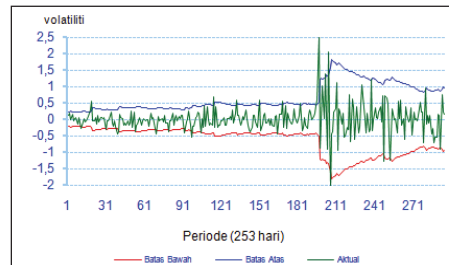
Source : Indonesian Financial Statistics, Bank Indonesia.

The pressure on the balance of payment during the second half of 2011 is balanced with the adoption of a mix of domestic policies in respect of foreign capital management, strengthening of the banking sector through interest rates and exchange rate policies, and macro-prudential policies supplemented with a better domestic financial infrastructure. The impact of the European crisis actually appeared since the third quarter of 2011, reflected by the increased volatility of government bond price. Pressures of a sudden capital reversal were closely monitored considering the impact of the debt crisis in Europe, which has already spread to peripheral countries, encouraged investors to withdraw their investments. This flight to safety appeared in the form of SUN price volatility at the end of the third quarter and throughout the fourth quarter.The volatility of government bond price was up to 2% since September 2011. A lack of clarity in terms of debt crisis resolution in Greece and in the peripheral European countries also ratcheted up the volatility in government bond prices up to the end of second half of 2011. Finally, this volatility will exert pressure on financial stability.

Figure 18
Government Bond Price Volatility
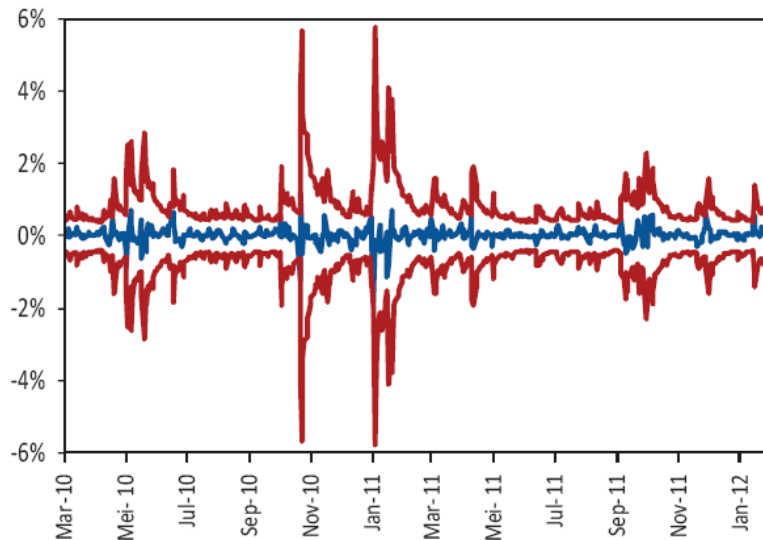
5. Assessing Current Financial System Stability Framework

Financial system stability is maintained when financial markets are functioning well, key institutions in the financial system are not facing operational problems, and asset prices are not in excess of their fundamental values. These will be the key towards sustainable growth and low inflation rates, and also stabilisation of fluctuations in asset prices and growing uncertainty. On the other hand, financial instability will hamper economic activities and jeopardise social welfare. If the financial system and key financial institutions do not function well, there will be stress on corporates and households, resulting in a credit crunch.

Policymakers need to respond to stress in the financial system by changing the stance of monetary policy, but they must be mindful that a sudden change in monetary policy may trigger financial uncertainty and jeopardise the effectiveness of the monetary policy transmission mechanism., A sudden price movement may be triggered when the market is responding to new information and it may lead to enormous losses, high level of uncertainty and risk aversion. This is caused by the existence of the inter-linkage between the financial system, economic condition and monetary policy. Monitoring the financial market and

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assessing financial stability are important duties of a policymaker. Therefore, sufficient time and resources should be allocated for the assessment of the financial system as a whole to measure spill-over from the distressed financial sector to the non-financial sector.

The financial and real sector is one integrated entity. In assessing the Greek crisis spill-over, we have performed stress testing on the impact of international trade and foreign loans on corporates. Stress testing is conducted by involving debitors who trade with PIIGS (Portugal, Italy, Ireland, Greece and Spain) and the US. However, such stress testing is still sporadic in nature and is a response to the current developments in economic conditions. Currently, the monitoring of the corporate sector is limited to public-listed companies and hence it does not take into account the large family-owned businesses. In addition, data collection and tools are necessary to comprehensively cover the sector. Some points that should be followed up are: (i) Corporate details to be collected using data from the Bureau of Statistics, Ministry of Trade and Industry, and Tax Office; (ii) regular surveys to be conducted on individual corporates to obtain performance data; and (iii) regular monitoring tools to be established.

It is clear that strong and effective coordination is necessary between the various government bodies to monitor the impact of a shock to the Indonesian economy. It is also important to uproot the fundamental causes of financial stability itself. Schinasi (2006) showed that the financial system has developed far beyond the real sector. The total financial assets in 2000 have increased more than three fold in the developed countries.

Figure 19
Composition of Key Financial Aggregates in 1970 and 2000
(in % of GDP, average of the United States, United Kingdom, Japan,
France, Italy, Canada, and the Netherlands.
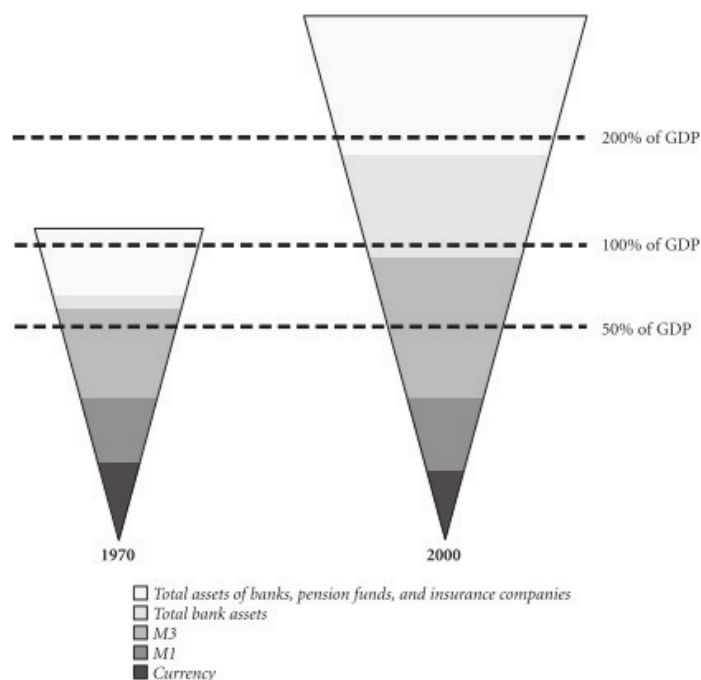
Source: Shinasi, 2006.

6. Recommendations and Policy Implications

The development of instruments based on the real sector should be pushed in order to counterbalance the speed of financial asset developmet. This issue is in line with the current issues regarding financial system stability that were highlighted in the G-20 meeting in October 2011, specifically:

1) **Application of international financial standard**
   Related issues cover the monitoring of staff capacity, insufficiency of legal platform, availability of adequate regulation in monitoring financial conglomerates and adoption of an international standard.

2) **Promotion of cross-border supervisory cooperation**
   The acitivity of foreign banks will result in a home-host supervision conflict. The presence of a strong coordination framework between home and host country involving information sharing, evaluation of complex risks and cross-border resolution is required.

3) **Expansion of regulatory and supervisory parameter**
   In the developed and developing countries, non-bank institutions have proliferated in tandem with risks imposed by such institutions. This recent development of non-bank institutions has not brought about an improvement in asset quality which may jeopardise the financial system as a whole. Lack of regulation and monitoring of these institutions have contributed towards this problem.

4) **Management of foreign exchange risks**
   Exchange rate risk will become stronger where the domestic financial market is in its infancy, with high dollar demand and limited hedging options to counter mismatch. This results in banks exposing their currency risk through net open positions or currency-related lending.

5) **Development of domestic capital market**
   The lack of depth in developing countries' stock market is prone to give rise to excessive market movements. This may create unfavourable sentiments amongst investors which will in turn affect liquidity of the capital market. The broadbasing of the capital market to domestic investors and improved market infrastructure are two important things to maintain financial stability. In this regard, increasing market depth in the capital market with real sector based assets will counterbalance financial assest while the promotion of retail based financial asset instruments will provide more investment options for domestic investors as an alternative to deposits in bank.

7. Conclusion

The establishment of financial indicators in response to the rapid development of financial instruments needs to be done by identifying the source of the problems correctly. Financial assets need to be put back to where they belong to support the real sector. As long as financial assets far exceed real assets, there will always be inherent risks to financial stability. Therefore, the efforts to reduce financial instruments which are not based on the real sector should be supported and become an important target for policymakers.

Furthermore the development of real sector based instruments should be taken into account to ensure the sustainability of economic growth. Besides that, early monitoring of the impact of shocks on corporates and households also needs to be sustained. Therefore, the supply of basic data and/or information on corporates and households through surveys needs to be developed.

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Chapter 5

**STRENGTHENING FINANCIAL STABILITY INDICATORS IN
THE MIDST OF RAPID FINANCIAL INNOVATION:
UPDATES AND ASSESSMENTS IN NEPAL**

By
Sudip Phuyal[1]

1. Introduction

The promotion of financial soundness and stability is increasingly recognised as one of the prime responsibilities of monetary and financial authorities throughout the world for the achievement of economic growth and sustainability. The global financial crises experienced during the late 1980s and 1990s prompted both national and international policymaking bodies to realise the importance of a sound financial system for unimpeded economic growth.

The 1990s was marked by a process of integration of the emerging market economies with global capital and currency markets. Domestic financial markets became much more liberalised and the international linkages also grew remarkably with an increasing free movement of capital across national boundaries. However, associated with these developments was a heightened tendency for financial instability, which manifested itself in increased volatility of capital flows, asset price misalignments and international contagion, and even sporadic crises. Both the frequency and severity of international financial crises rose over the last decade leading to severe economic disruption, increased unemployment and return to poverty for many economies, including Nepal. The experience of recent financial crises confirms a strong interrelationship between macroeconomic instability and financial instability. Financial stability requires both macroeconomic stability and structural policies and conditions consistent with a sound and efficient domestic financial sector. Against this backdrop, economies, particularly those facing increasing vulnerabilities to the volatility of international capital movements, required an adequate set of financial soundness indicators to monitor their financial systems.

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Financial soundness indicators (FSIs) are aggregate measures of the current financial health of the financial institutions and their corporate and household counterparties. Broadly, FSIs are compiled and disseminated to support macro-prudential analysis involving the assessment and surveillance of the strengths and vulnerabilities of financial systems with a view to limiting the likelihood of financial system failure. These indicators incorporate both aggregated individual institution data and indicators that are representative of the markets in which the financial institutions operate. Today, the dissemination of financial information is a regular feature of national and international bodies responsible for financial sector surveillance. In recent times, Nepal has been paying more attention to monitoring the governance, health and efficiency of financial institutions and markets as well as the macroeconomic and institutional developments that pose potential risks to financial stability.

1.1 Existing Policies for Promoting Financial System Stability

The Nepal Rastra Bank (NRB) is mandated by its Act to maintain sound, sustainable and credible macroeconomic policies, including a monetary policy aimed at promoting price stability, which is the primary requirement for financial stability. The objectives of the NRB include the formulation of monetary and foreign exchange policies to maintain price stability and a sustainable balance of payments while promoting and safeguarding the banking and financial system through supervision and regulation with a view to enhancing the public credibility of the financial system. Moreover, the NRB is also mandated with the task of developing a secure, healthy and efficient system of payment. Towards this end, the NRB formulated monetary policy to maintain price stability and adopted an exchange rate policy to maintain stability in foreign exchange adjustment. In the financial sector, the NRB has adopted policies to encourage banks to manage their risk prudently including corporate governance and financial disclosure while enforcing effective bank supervision arrangements. In the area of financial infrastructure, the NRB implemented policies to promote robust payment system and minimise interbank contagion through netting arrangement, real time gross settlement and failure-to-settle structures within the payment system.

The NRB presently is taking further steps towards strengthening the financial system. One of the landmark events in its efforts was the issuance of "Risk Management Guidelines" in 2011. The NRB has recently introduced stress testing guidelines for A-class financial institutions (commercial banks) as a measure for detecting the early warning signals. This is also considered an effective monitoring and supervisory tool. The NRB has also started monitoring liquidity more closely under its Liquidity Monitoring Framework. A Bank Resolution Framework is

being drafted for crisis management in handling failing banks and financial institutions.

The government of Nepal adheres to a pragmatic budgeting system that ensures balanced development of different socio-economic and financial infrastructure. The government has endeavored to bring about an effective legal and judicial system, facilitating the enforcement of legal contracts. The joint effort of the government and the independent regulators of banking, insurance and securities market have also supported financial stability in recent past. Measures such as the provision of sufficient capital to absorb licensed institutions' losses and adverse exogenous shocks and permission for foreign ownership of banks to augment domestic private capital and intensify competition, have improved the legal system, particularly with regard to bankruptcy and debt recovery laws, and improved the banking infrastructure, including the training of both bankers and bank regulators; and have supported the maintenance of financial stability.

1.2 Objectives and Importance of the Study

In order to address financial sector vulnerability and the methods of analysis, there is a need to develop the appropriate indicators. However, there is no universally accepted set of indicators for monitoring financial markets. The International Monetary Fund (IMF) has introduced financial soundness indicators (FSIs) which are indicators compiled to monitor the health and soundness of financial institutions and markets, and of their corporate and household counterparts. FSIs include both aggregated micro-prudential indicators of the health of financial institutions and indicators that are representative of markets in which financial institutions operate. The objective and importance of this study is the identification of an appropriate set of country-specific FSIs which is best suited for the assessment of the strengths and vulnerabilities of the Nepalese financial systems while signaling financial crisis.

1.3 General Outline

This research paper is divided into several sections. Following the introduction which outlines the background, scope and objectives of the study and the brief explanation of the concept of financial stability indicators, Section 2 provides an introduction to the current structure of the financial system in Nepal. Section 3 reviews the literature on financial instability and the development of macro-prudential indicators and FSI indicators. Section 4 deals with the specification of macro-prudential indicators for Nepal. Section 5 provides a glimpse of the efforts that NRB has taken to enhance financial sector stability. Section 6

proposes some policy recommendations to further improve the current financial structure. Section 7 concludes with a summary of the study and advocates policy recommendations considered necessary for dealing with the FSIs.

2. Financial Stability Indicators

2.1 Macro-prudential Indicators (MPIs)

The MPIs are a broad set of indicators that reflect the vulnerability of the financial and real economic systems to shocks. The importance of MPIs in any analysis, especially those carried out under a policy framework on vulnerability analysis, cannot be over emphasised in light of the extensive damage currency, banking and financial crises could inflict on the economy.

The development of the MPI is rather recent, as indicated earlier. The tools that are utilised to quantify and qualify the soundness and vulnerabilities of the financial system are varied and can potentially be made as complex or sophisticated as needed. Depending on the complexity, the operation of a monitoring system demands resources and technical expertise. The IMF, for instance, uses aggregated micro- prudential data to assess the current health of financial institutions. In addition, for their own monitoring purposes, the IMF employs stress tests and scenario analysis to determine the sensitivity of the financial system to macroeconomic shocks, most importantly as part of the IMF's comprehensive financial sector stability assessments (FSSAs) of its member countries, and increasingly in its routine surveillance (IMF, 2001a).

The IMF's MPI analysis will be evaluated to determine how well it can track the vulnerability of financial system as well as how it can effectively disseminate the information to economic agents in the pursuit of better disclosure. Despite the increasing interest in more complex techniques that are used in the deployment of monitoring and early warning systems, it should be borne in mind that there are at least two aspects in monitoring—the technical identification and interpretation of the indicators. Although the MPIs are not comparable across countries due to differences in their definition, or in data availability or accounting/ compilation standards, it is still instructive to contrast the patterns of the MPIs of crisis-affected countries with those of countries that did not suffer from a similar turmoil. The availability of the MPI could initially form the basis of a peer review process, which could be further refined and formalised as the practice is carried out.

The deposit-taking financial institutions pre-dominate the financial system of Nepal. Among these institutions, the banking sector's share in the total deposits and lending is more than two thirds. Therefore, the main issues regarding financial stability in Nepal that necessitate promotion and improvement of financial stability are explained as follows. The rapid liberalisation of the financial sector unsupported by measures to encourage prudent risk management in the financial sector is mainly responsible for potential financial instability in Nepal. Financial liberalisation usually lowers the cost of capital, increases returns to savers, provides improved opportunities for risk diversification, and increases market discipline.

Poor and inadequate supervision of banks and financial institutions due to lack of skilled human resources, advance technology and modern supervisory infrastructure, have resulted in banking and insurance institutions operating at their own discretion seeking short-term profit only and without addressing risk management, which eventually leads to financial distress for the individual entity and contagion for the financial system as a whole. Weak market discipline in the banking and other corporate sectors is also a pressing issue in Nepal. The international best practices of corporate disciplines have not been fully complied with, which makes banking, insurance and securities markets more vulnerable to the internal weaknesses caused from their own indiscipline. There is excessive credit creation in the system that has been adversely affected due to high inflation. The unsound, shortsighted and speculative financing of the unproductive sectors of the economy has been having major implications on the banking system with plausible asset price bubbles, booms and busts in the economy with the lack of predictability and certainty.

Despite the regulations and supervision of the NRB and other regulators in their respective jurisdictions, the banks and other financial institutions practise poor corporate governance. Issues in relation to connected lending, weak internal control and low level of transparency are observed in these entities.

2.2 Structure of Financial System in Nepal

The Nepalese financial sector is composed of banking institutions and other financial institutions. Banking institutions comprise the NRB and commercial banks. The other financial institutions include development banks, finance companies, micro-credit development banks, co-operatives, non-governmental organisations performing limited banking activities and other financial institutions not licensed by the NRB, such as insurance companies, employees provident fund, citizen investment trust, and the Nepal Stock Exchange.

With the initiation of economic liberalisation in the late 1980s and early 1990s, the Nepalese financial sector also liberalised with a significant increase in the number of financial institutions in the country. Prior to the liberalisation, the financial system consisted of only two commercial banks and a few other financial institutions. Since then, during the post-liberalisation period spanning over nearly two decades, the financial system has developed, diversified, and deepened remarkably. As of mid-July 2012, the financial system consisted of 32 commercial banks, 88 development banks, 70 finance companies, 23 micro-finance development banks, 16 saving and credit co-operatives involved in limited banking activity, 37 non-governmental micro-credit institutions, one Stock Exchange with a network of brokers and securities dealers, 25 insurance companies, one employee's provident fund and one citizen investment trust. Of these institutions, the commercial banks, development banks, finance companies, micro-finance development banks, some 16 co-operatives and NGOs are under the regulatory and supervisory framework of the NRB. While the Insurance Board regulates the insurance companies and the Securities Board regulates the Stock Exchange, the other institutions are under the overall regulation of the government. The number of financial institutions and their major financial indicators are as shown below:

Figure 1
Number of Financial Institutions

Financial Institutions	Mid-July						
	2000	2007	2008	2009	2010	2011	2012
Commercial Banks	13	20	25	26	27	31	32
Development Banks	7	38	58	63	79	87	88
Finance Companies	45	74	78	77	79	79	70
Micro-Finance Dev Banks	7	12	12	15	18	21	23
Co-operatives	19	17	16	16	16	16	16
NGOs	7	47	46	45	45	38	37
Total	**98**	**208**	**235**	**242**	**264**	**272**	**266**

Source: Nepal Rastra Bank.

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Figure 2
Deposits, Credits and Total Assets of Financial Institutions

($ in Millions)

Banks and FIs	Deposits		Loan and Advances		Total Asset	
	Amount	%	Amount	%	Amount	%
Commercial Banks	9771.7	78.7	7508.5	73.5	12482.7	75.3
Development Banks	1378.2	11.1	1266.7	12.4	1989.3	12.0
Finance Companies	1216.8	9.8	1236.1	12.1	1806.9	10.9
Micro-finance Development Banks	49.7	0.4	204.3	2.0	298.4	1.8
Total	**12416.4**	**100**	**10215.6**	**100**	**16577.3**	**100**

Source: Nepal Rastra Bank.

Commercial banks are the key institutions in the financial system with more than 75% of the total assets and liabilities of the system. As of mid-July 2011, commercial banks held 75.3% of total assets/liabilities followed by finance companies at 12.0%, development banks 10.9% and micro-credit development banks at 1.8%. Similarly, the distribution of loans and deposits shows the same trend. In the case of loans, commercial banks accounted for 73.5% followed by development banks at 12.4%, finance companies 12.1% and micro-credit development banks at 2.0% share. In the case of deposits, commercial banks accounted for 78.7% followed again by development banks at 11.1%, finance companies at 9.8% and micro-credit development banks at 0.4% share. Commercial banks dominate the financial system of the country with the majority share of most financial transactions.

Figure 3
Growth of Major Balance-Sheet Indicators
of Financial Institutions (%)

Indicator	Mid-July					
	2006	**2007**	**2008**	**2009**	**2010**	**2011**
Capital Fund	17.90	192.50	273.5	104.36	53.43	36.9
Borrowings	34.61	22.32	17.55	12.73	7.51	23.8
Deposits	15.42	19.28	30.10	32.55	17.75	10.8
Liquid Funds	4.23	21.66	68.64	45.18	10.00	-0.8
Investment	33.76	14.53	18.11	17.46	2.91	10.2
Loans and Advances	10.22	26.55	34.27	30.70	21.31	15.8

Source: Nepal Rastra Bank.

The capital fund, one of the components of liabilities, witnessed a growth of 36.9 % and reached $1,504.1 million in mid-July 2011 from $1,098.3 million in mid-July 2010. The borrowings and deposit increased by 23.8% and 10.8%, respectively, compared to mid-July 2010. Similarly loans and advances, including bills purchased, the major component of assets, increased by 15.8% and reached $10,215.7 million in mid-July 2011, from $8,825.0 million in mid-July, 2010. The investment increased by 10.2% in mid-July 2011. Due to facing liquidity problem in commercial banks, the liquid funds slightly decreased by 0.8% in mid-July 2011, compared to mid-July 2010. The trend of total credit and total deposit of the financial institutions to GDP are as follows:

Figure 4
Total Credit and Total Deposit of Financial Institutions
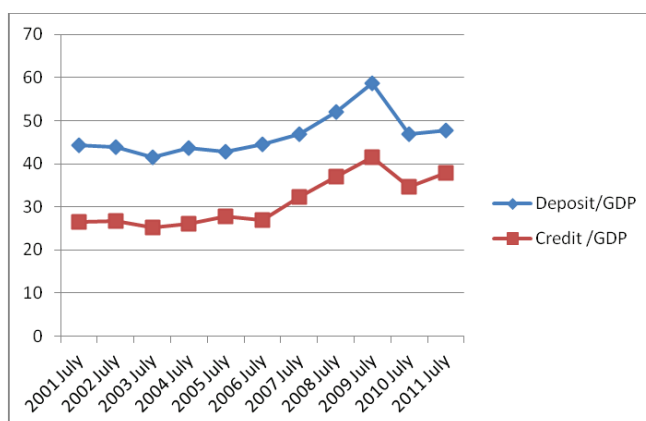
2.3 Aggregated Micro-prudential Indicators (FSIs)

The aggregated micro-prudential indicators mainly adopt the CAMELS framework, which comprises six groups of indicators reflecting the health of financial institutions: capital adequacy, asset quality, management soundness, earnings, liquidity, and sensitivity to market risk. The macroeconomic indicators are the indicators of soundness in the banking sector and form an integral part of banking supervision (IMF, 2003). In addition, the macroeconomic variables reflect the overall economic activity and the vulnerability of the economy to shocks particularly to currency crises and capital flow reversals. Market-based indicators, on the other hand, incorporate information such as interest rate spreads, not found in the CAMELS, having a bearing on the market or foreign exchange risk of a particular country.

2.4 Stress Tests and Scenario Analysis

Stress tests could facilitate macro-prudential surveillance by identifying potential vulnerabilities and overall risk exposures in the banking system that may lead to systemic problems. Stress testing has increasingly emerged as an accepted mode for assessing the vulnerability of the financial system to exceptional but plausible stress events. The vulnerabilities and resilience of commercial banks have been tested under various scenarios impacting their credit, interest rate and liquidity risks by calibrating the stress factors. Supervisory stress tests are conducted with the main objective of assessing the resilience of banks

to potential risks and vulnerabilities, both at the level of individual banks and for the banking system as a whole. Such stress testing facilitates the strengthening of the information set and consequent refinement of the prudential supervisory process so that more in-depth analyses can be conducted on individual banks identified as outliers. This could assist in the introduction of appropriate early preventive measures. The quantitative response models generally employ econometric techniques to estimate the relationship between the macroeconomic variables and banking sector conditions to study the impact of stress conditions.

In Nepal, conducting stress testing is a difficult exercise due to the lack of adequate and relevant past time-series data (Depakraj, 2010). For example, the data on asset prices are inadequate – no reliable system-level data is available for commercial real estate prices – which would be the primary input to assess the impact of asset price inflation on the economy. In formulating the quantum of shocks, judicious criteria on selected indicators based on the experience of the Nepalese financial system are applied. Based on the supervisory data, individual banks' positions are examined by applying shocks in respect of a single key variable, which is then related to an important financial soundness indicator – typically the regulatory capital adequacy ratio. The same analysis is also carried out for the system as a whole by aggregating the impact across individual banks.

NRB has in recent times also issued stress testing guidelines as a risk management and supervisory tool for the detection of early warning signals. The stress testing is done on the most sensitive areas of commercial banking business viz. credit risk, market risk and liquidity risk. Nepal has yet to develop the Financial Soundness Index to measure the financial soundness of the financial system. However, the financial soundness of the system is measured from the following ratios: Non-performing loans /total loans; regulatory capital/risk weighted assets; and liquidity ratio.

2.5 Use of FSI as 'Early Warning Signal'

An early warning system (EWS) is a system which enables the detection of risks that may result in a high probability of financial difficulty, so that policies and corrective action can be designed and implemented as soon as possible. The essence of an EWS lies with the identification/indication of weakness, which may lead to the problem in future.

Financial analysis and review of off-site supervision operate as an early warning system in Nepal. An early warning signal helps to identify those commercial banks which display a high probability of financial constraints. Off-site analysis is not intended to replace on-site inspection but only to supplement the inspection procedures. Off-site supervision reports are useful to identify the areas of review in the pre-on-site inspection planning process. Risk-focused inspection (special inspection) and corporate level inspection are used to trace out the EWS. Off-site supervision report helps to bridge the gap between on-site inspections and provides a formalised system to resolve deficiencies. Top priority issues that can be identified through this method are issues that compromise banking standards or cause problems for sound banking practices. Early detection will hopefully benefit the supervisory effort by reducing the probability of any bank becoming a "problem bank", thereby reducing the amount of time necessary to monitor these banks. The EWS should also be a key component of inspection planning so that maximum benefit is achieved from the limited time spent conducting an on-site review. Also, comparing the trend of ratios will give some indication if conditions are improving or deteriorating.

It is a matter of common knowledge that whenever there is a problem in a financial institution, the initial area that gets hit would be its liquidity, capital being the last. As the NRB understands this fact, the liquidity situation is being monitored more frequently and more closely under its "Liquidity Forecasting Framework". This is considered essential for identifying the liquidity triggers under its Liquidity Prompt Corrective Action (PCA).

The degree of off-site supervisory concern in one or more of the component areas of the banks with code "R" is higher. These banks should be monitored in respect of each component of CAELS rating of 4 or 5 individually. All the banks should be identified with their component problems rather than evaluating banks on basis of the composite rating of 3. Normally, a bank does not turn out to be a problem bank without showing phase of degradation of ratios. Thus, continuous off-site surveillance is to take preventive measures before a bank is assigned a code "P".

3. Literature Review

3.1 Theories of Financial Instability

The role of financial institutions within a financial system is primarily to intermediate between those that provide funds and those that need funds, and it typically involves transforming and managing risk. Particularly for a deposit-

taker, this risk arises from its role in maturity transformation, where liabilities are typically short term, (e.g., demand deposits), while its assets have a longer maturity and are often illiquid (e.g., loans). Financial markets provide a forum within which financial claims can be traded under established rules of conduct, and can facilitate the management and transformation of risk. They also play an important role in identifying market prices ("price discovery").

Within a financial system, the role of deposit-takers is central. They often provide a convenient location for the placement and borrowing of funds and, as such, are a source of liquid assets and funds to the rest of the economy. They also provide payment services that are relied upon by all other entities for the conduct of their business. Thus, the failure of deposit-takers can have a significant impact on the activities of all other financial and non-financial entities and on the confidence in, and the functioning of, the financial system as a whole. This makes the analysis of the health and soundness of deposit-takers central to any assessment of financial system stability. There is as yet no generally accepted definition of financial stability. Nonetheless, financial stability is understood to apply to both institutions and markets. Financial stability requires that (Mukunda Mahat, 2010).

a. The key institutions in the financial system are stable, in that there is a high degree of confidence that they can continue to meet their contractual obligations without interruption or outside assistance; and

b. The key markets are stable, in that participants can confidently transact in them at prices that reflect fundamental forces and that do not vary substantially over short periods when there have been no changes in the fundamentals.

Stability in financial institutions means the absence of stresses that have the potential to cause measurable economic harm beyond a strictly limited group of customers and counterparties. Banking institutions are the key financial institutions central to the smooth functioning of the financial system. Their failure would cause a systemic crisis via greater susceptibility to runs and the operation of the payments system. The money, foreign exchange, corporate bond markets, and equity and derivative markets should also be stable. The rapid growth of financial markets in Nepal may pose greater threat to stability. Financial markets impact through wealth effects as financial asset prices change; changes in the expected returns on saving and investment or through a more generalised impact on consumer and business confidence.

Financial instability occurs when shocks to the financial system interfere with information flows so that the financial system can no longer do its job of channeling funds to those with productive investment opportunities. Indeed, if financial instability is severe enough, it can lead to almost a complete breakdown in the functioning of financial markets, a situation which is then classified as a financial crisis. This is a more precise way of explaining the generalised loss of confidence that lies behind the rush for "secure" assets and the dis-intermediation that characterises periods of extreme financial stress in the banking system.

3.2 Studies on Aggregated Micro-prudential Indicators (MPIs)

Since the advent of the Asian crisis in 1997, the IMF has collaborated with national authorities and other international financial institutions in developing MPIs[2] and formulating methods in analysing these indicators of financial soundness. This interest was stimulated, in general, by rethinking the effectiveness of the mode of the IMF surveillance prior to the Asian crisis. Indeed, the fact that the Asian crisis was largely unanticipated has exposed the gaps in surveillance systems on the national, regional and global levels, including within the IMF's bilateral and global surveillance systems. As part of the response, the IMF has worked to create a new architecture of the global financial system, which incorporates more enhanced monitoring and early warning processes, as well as create strong public disclosure and public information requirements in the design of the new financial architecture. In particular, the IMF has started to include financial sector surveillance as a core activity to enhance traditional IMF bilateral surveillance, which during the pre-crisis period, tended to concentrate on macroeconomic policies and balance of payments, and paid lesser attention to issues such as the consequences of financial liberalisation, maturity mismatches, build-up of fragility in the financial system, and other capital account issues (IMF, 2003). These aforementioned issues have been at the core of the loss of confidence in the region during the crisis. Since then the IMF has been working on a series of initiatives to enhance its ability to assess the strength and weaknesses of financial systems and develop the analytical and procedural tools to perform this task. Among these initiatives are the ongoing efforts to develop and use MPIs.

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2. The IMF now refers the MPIs as financial soundness indicators.

The IMF considers macro-prudential analysis as a key element in designing a policy framework for vulnerability analysis. While the focus is the soundness or health of the financial system, it also incorporates general macroeconomic analysis as well as structural analysis to supplement the assessment of the financial system. Among the major components in macro-prudential analysis is the specification of MPIs, which are indicators needed in producing reliable assessments of the strengths and vulnerabilities of financial systems, and the encouragement of enhanced disclosure of financial indicators to the markets (IMF, 2003). Moreover, MPIs are an integral part of the FSSAs, in which they provide inputs to stress the testing exercises, and will be increasingly integrated into the regular IMF surveillance of economies whenever major financial sector issues are to be analysed. One can note that the objectives of macro-prudential analysis directly address the two major causes of the crisis—the weakness in the financial sector which was largely undetected and the destabilising capital flows owing to abrupt shifts of investor sentiments. Thus, timely and appropriate information is a very key element in the process.

The set of MPIs is the statistical building block of macro-prudential analysis. It needs be appreciated that in an increasingly complex and integrated global setting, there are myriads of channels where the banking or financial sector can be affected. For example, domestic variables such as credit growth, as well as international ones such as world interest rates, could have an impact on the health of the banking or financial system. Hence, there are potentially numerous indicators that can be examined. In addition, structural issues such as ownership structure and concentration could also affect the robustness of the financial system. Furthermore, there are different levels of analysis that can be conducted and each type calls for different MPIs. For instance, macro-prudential analysis focuses on the system-wide health and stability whereas micro-prudential analysis deals with conditions of individual financial institutions (Crockett, 1997). Given the aforementioned considerations, the IMF has adopted a small "core set" of MPIs, which includes mainly aggregated microeconomic indicators of the health of the financial institutions and indicators of the health of the major clients of financial institutions. Furthermore, the coverage of the MPIs also extends to the indicators of key market developments in which financial institutions operate, such as the real estate market. Because of the increasing interdependence of the different sectors in an economy and between economies, the set of MPIs should be comprehensive. The IMF's initial list of MPIs has three main groupings—aggregated micro-prudential indicators, macroeconomic indicators and market-based indicators—to reflect the health of financial institutions and the broader systemic soundness of the financial system.

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4. Framework for Macro-prudential Indicators Analysis

4.1 Specification of Aggregated Micro-prudential Indicators

4.1.1 Financial Stability Indicators for Deposit-takers

Deposit-takers play a pivotal role in financial systems. Their financial situation and resilience to shocks is therefore of paramount importance for financial stability. The core set of indicators covers the key ratios with regard to the deposit-takers. Out of the total 12 cores and 27 encouraged set of FSIs, the NRB has only produced 7 core and 2 encouraged set of indicators for deposit-taker institutions.

Figure 5
Financial Stability Indicators in Nepal

Core Set	FSIs	2005	2006	2007	2008	2009	2010	2011
Capital	Regulatory Capital /RWA	-	-	-	4.0	7.2	9.6	10.6
Adequacy	Tier 1 Capital/RWA	-	-	-	1.8	5.2	7.9	9.1
Assets Quality	NPL/Total Loan	18.7	12.9	9.7	6.1	3.6	2.5	3.2
Earning & Profitability	ROA	1.9	2.3	2.2	2.2	2.4	2.1	1.9
	ROE	52.4	64.4	45.5	143.6	81.3	51.8	41.1
Liquidity	Liquid asset to total assets	32.8	30.4	29.6	12.9	15.8	13.6	23.9
Encourage set	**FSIs**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
	Capital to Assets	3.7	3.5	4.8	3.0	5.6	7.9	9.1
	Net Interest Spread	3.9	4.2	4.3	3.9	4.1	4.8	4.7

Source: Nepal Rastra Bank.

4.1.1.1 Capital Adequacy Position

Capital adequacy position measures the ratio which determines the bank's capacity to meet the time liabilities and other risks, such as credit risk, operational risk, etc. Capital adequacy ratio measures the overall capital position of the banking system to risk-weighted assets, which indicates the risk absorption level of capital. As per NRB regulation, the required minimum level is 5.5 % for Tier 1 capital and 10 % for regulatory capital-to-risk weighted assets. The capital

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adequacy ratio till 2010 shows the Nepalese banking system has not even maintained sufficient capital requirement for risk mitigation of the financial system. The main reason for low capital is the large negative capital reserves of the three government-owned commercial banks.

Figure 6
Capital Adequacy
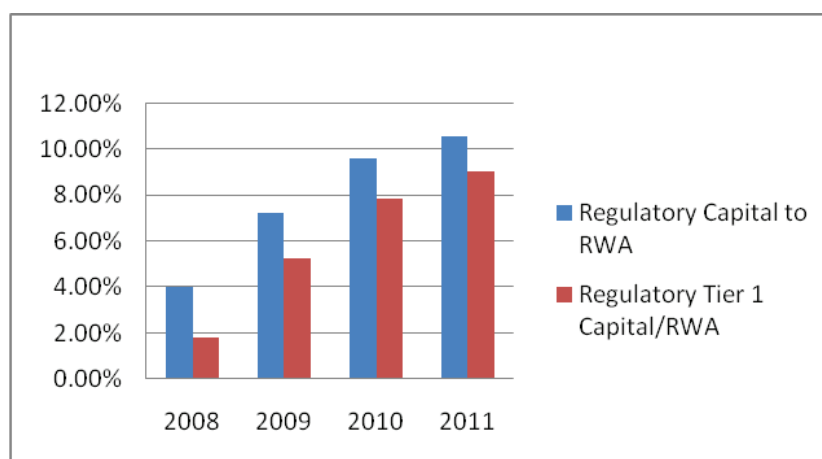
4.1.1.2 Asset Quality

Asset quality measures the impairment of assets due to the deteriorating financial position of borrowers. This indicator sets customer loans requiring individual value adjustments in relation to the institutions' total gross customer loans. It is determined by setting non-performing loans – which, according to the national definition, are calculated on the basis of customer loans requiring individual value in relation to the total customer credit volume. The maximum level of NPL is up to 5 %. The current NPL level is slightly higher in comparison to the previous year due to a fall in the prices of the real estate market in Nepal.

Figure 7
Non-performing Loans
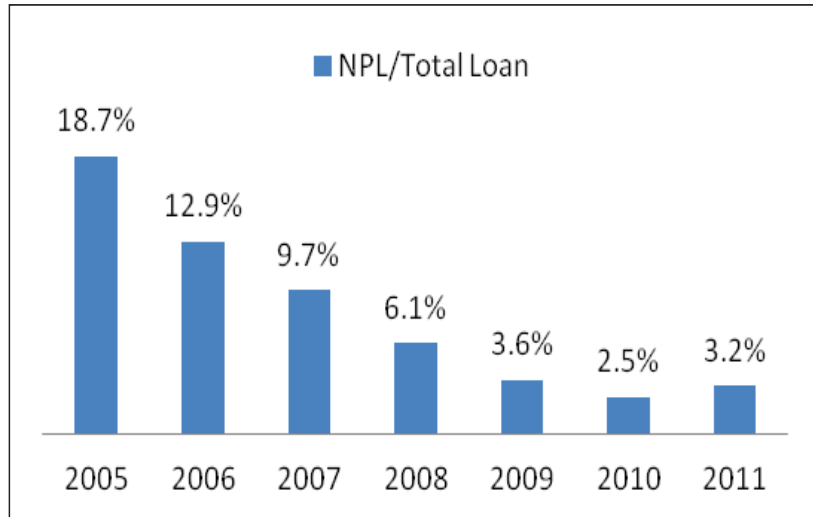
4.1.1.3 Earnings and Profitability

The return on assets is used to assess profitability in relation to average assets within an accounting period for purposes of comparison. The indicator is calculated as the ratio of profit for the financial year before tax to assets. Likewise, the return on equity captures the rate of remuneration of equity capital within an accounting period. The indicator is calculated as the ratio of profit for the financial year before tax to the average equity capital. Due to low utilisation level of capital in the market, the return was too higher as well as ROE in 2008 in comparison with the other years. The earnings on assets and equity of financial institutions are shown in the following figures:

Figure 8
Return on Equity and Profit Position
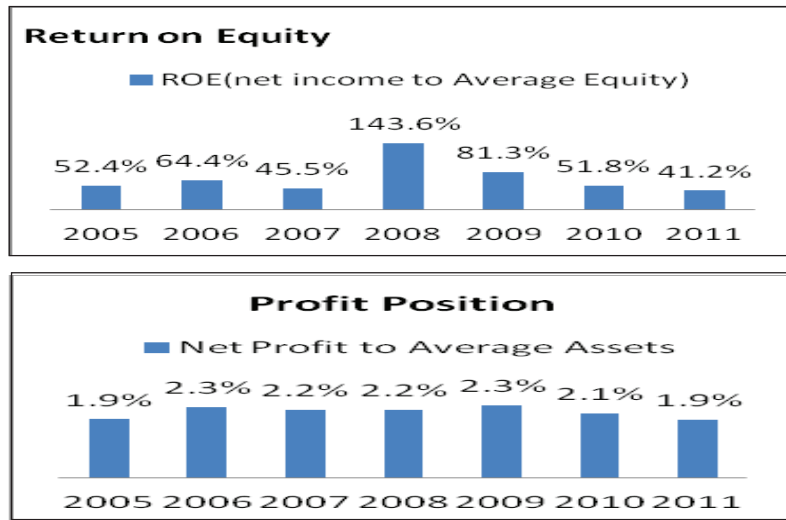
4.1.1.4 Liquidity

This indicator is calculated as the liquid assets to the institutions' total assets. The liquid asset position is on an increasing trend in the Nepalese financial system due to the liquidity requirement, including statutory liquidity ratio for banks and financial institutions by NRB. Now the existing requirement of liquidity for banks and financial institutions is 30% of total assets.

Figure 9
Liquid Asset to Total Assets

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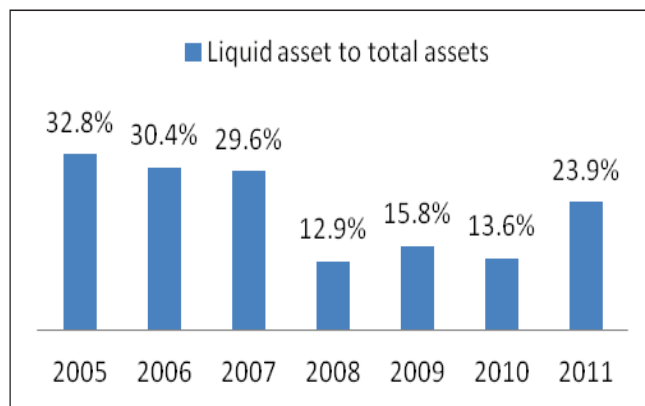
4.1.6 FSIs for Other Financial Corporations

Other financial corporations are linked to deposit-takers in many different ways and can likewise be of systemic relevance to financial system stability. (Data are not available.)

4.1.7 FSIs for Non-financial Corporation (Corporate Sector)

Non-financial corporations are the financial sector's key (credit) customers. If the situation in the non-financial corporations sector deteriorates, this leads to a decline in the non-financial corporations' creditworthiness and debt repayment capability which, in turn, may have a direct adverse impact on the financial institutions' performance. The data available for non-financial corporations are, all in all, somewhat less comprehensive than those for the financial sectors, which is why various data sources must be consulted. (Data are not available)

4.1.8 FSIs for Households

Households affect financial institutions both directly and indirectly; directly through their decision to invest their savings or to take out loans, and indirectly through their consumption behaviour which, in turn, has an impact on the financial sector. However, the FSIs are not available for this sector.

4.1.9 FSIs for Real Estate Markets

The cyclical developments in the real estate markets are highly correlated with the lending behaviour of the financial sector. A real estate boom is often preceded or accompanied by a sharp rise in lending to the private sector. By contrast, a downturn in the real estate market is frequently flanked by a marked decline in lending. Moreover, financial crises in the past have often been preceded by a strong downturn in the real estate market. However, data with regard to real estate market is not available.

4.2 Specification of Macroeconomic and Market-based Variables

4.2.1 Economic Growth

According to the preliminary estimates of the Central Bureau of Statistics (CBS) and the Government of Nepal, Nepal's economy in FY 2011/12 will grow at 4.56% at real prices and 4.63% at current prices against the earlier estimated 5.0%, which is the highest in three years. The growth rates in FY 2009/10 and

2010/11 at base prices were just 4.3% and 3.9%, respectively. Increased agricultural production accompanied by growth in service sector outputs have been the major reason for such growth rate. Agricultural GDP in FY 2011/12 is estimated to grow by 4.93% compared to 4.51% growth in the previous fiscal year. The growth rate of the non-agriculture sector is estimated at 4.27% in this fiscal year, which was 3.4% in FY 2010/11, whereas this sector's growth rate in FY 2009/10 stood at 5.39%. Gradual structural change can be observed in the Nepalese economy. A trend of decreasing contribution of the agriculture and industry sectors and increasing contribution of the services sector to GDP is clearly visible. On sectoral basis, the contributions of primary, secondary and tertiary sectors to GDP are estimated at 35.68%, 14.02% and 50.31%, respectively.

Figure 10
Real GDP Growth (%)
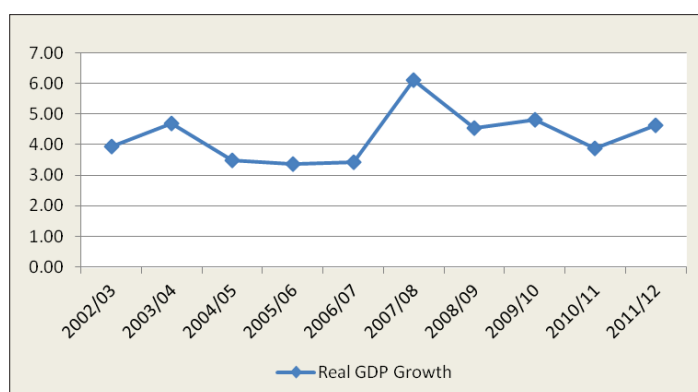
Fiscal Year	Real GDP Growth
2002/03	3.95 %
2003/04	4.68 %
2004/05	3.48 %
2005/06	3.36 %
2006/07	3.41 %
2007/08	6.10 %
2008/09	4.53 %
2009/10	4.82 %
2010/11	3.88 %
2011/12	4.63 %

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4.2.2 Inflation

Due to the increase in the price of food grains and petroleum products as a result of conflict in the Middle-east and North African countries, most countries including Nepal have been experiencing excessive pressure on consumer prices. Nepal has been facing double-digit inflation since the last two years. The rate of inflation continued to remain high in the current fiscal year. The annual point-to-point aggregate CPI by mid-July 2012 declined by 8.3% as compared to a 9.4% rise in the consumer inflation rate during the corresponding period of 2011. The annual point-to- point change in the prices of food and beverages category during this period recorded a rise of 7.7% by mid-July 2012 as compared to a 9.0% rise in non-food and services category during the same period.

<table>
<tr><th>Figure 11
Inflation (%)</th><th>Figure 12
Food & Non-food inflation (%)</th></tr>
</table>

Figure 11
Inflation (%)
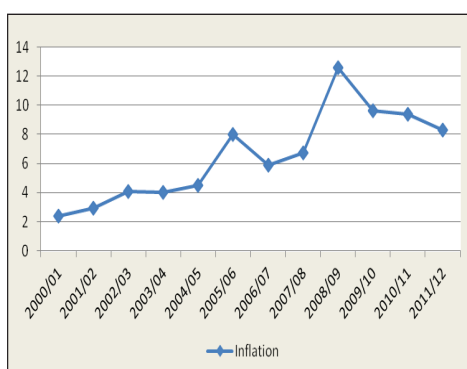
Figure 12
Food & Non-food inflation (%)
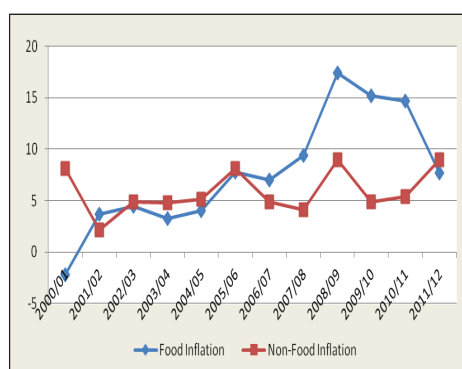
4.2.3 Balance of Payment

The overall balance of payments (BOP) recorded its highest surplus ever of US$1.61 billion during the eleven months of FY 2011/12 due to the noteworthy improvement in the external sector transactions. The overall BOP had witnessed a deficit of US $4.77 million during the corresponding period of the previous year. The overall BOP surplus stood at its historic high during the review period mainly due to the improvement in world economic outlook, high surplus (US$0.88 billion) in the current account arising from the amelioration in merchandise exports and inflows of remittances due to the depreciation of Nepalese rupee against the US dollar and surplus in the net services coupled with the substantial surplus (US$0.22 billion) in the capital account.

The gross foreign exchange reserves rose during the eleven months of FY 2011/12 because of the significant rise in the BOP surplus. Foreign exchange reserves increased by 25.6% to US$4.82 billion in mid-June 2012 from US$3.84 billion in mid-July 2011 in dollar terms. Based on the import trend of 11 months of the current fiscal year, the existing level of foreign exchange reserves is sufficient for financing merchandise imports for 11 months and merchandise and service imports for 10 months. Such reserve was sufficient for financing merchandise imports for 8.4 months and merchandise and service imports for 7.3 months during the corresponding period of the previous year.

Figure 13
Gross Foreign Exchange Reserve
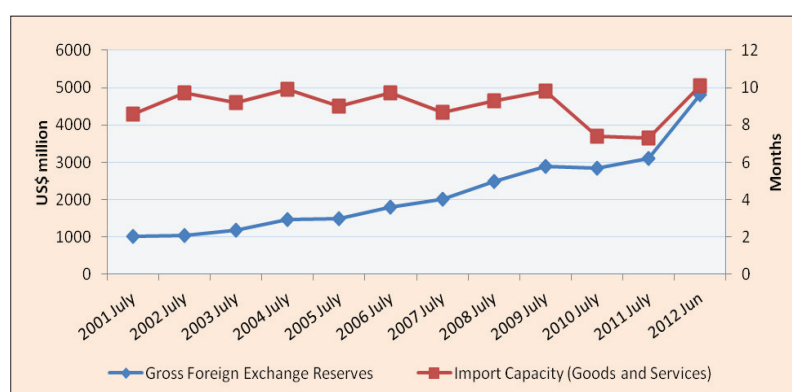
Nepal is heavily dependent on imports to meet the demand for both investment and consumer goods. The statistics show that Nepal imports most of its goods from its southern neighbour. Petroleum products, chemical fertilisers, chemicals, cement, medicines, textiles and vehicles and spare parts are the major commodities that Nepal imports from India. As a result of increase in exports to India and other countries by 16.7% and 15.6% respectively, the total merchandise exports increased by 16.3% during the eleven months of FY 2011/12. While exports to India had risen by 7.5%, exports to other countries did not rise during the corresponding period of the previous year. Total merchandise imports increased by 16.8% during the 11 months of FY 2011/12. Of the total imports, imports from India and other countries increased by 13.6% and 23.1%, respectively. While imports from India had risen by 22.8%, imports from other

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countries declined by 16.8% during the corresponding period of the previous year. The export-import ratio decreased to 16.0% in the eleven months of FY 2010/11 from 16.1% during the corresponding period of the previous year due mainly to the high growth and big volume of imports compared to exports. A bar diagram depicting the trade balance of Nepal for the last 12 consecutive fiscal years is presented as follows:

Figure 14
Trade Balance
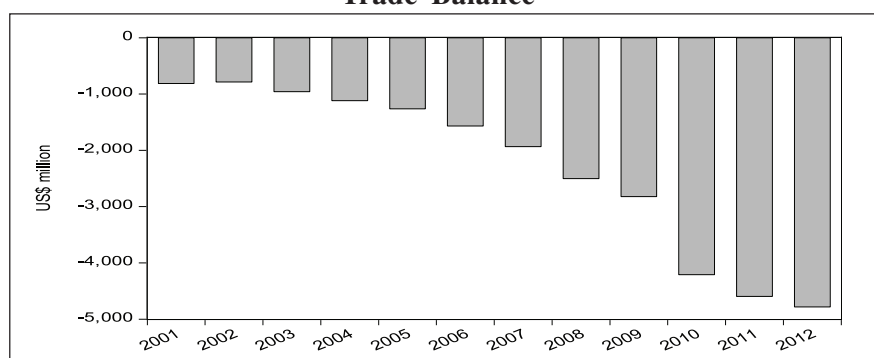
4.2.4 Interest Rate and Policy Rate

Among the various monetary policy instruments, the cash reserve ratio (CRR) is being used as a prime and effective instrument to inject liquidity and absorb liquidity from the economy. The CRR, which has been used particularly during the last few years to reduce the cost of the resources of commercial banks and to manage the necessary liquidity in the economy, has been reduced from 6.0% to 5.0% for FY 2004/05. The CRR was again maintained at 5.5% since 2008 July, but has been reduced by 0.5 percentage points to 5% from 5.5% in order to achieve the targeted economic growth through the supply of additional resources to the productive sectors with lower financial intermediation cost. Due to sufficient liquidity in the banks and financial institutions, the CRR is increased by 0.5% from 5.5% and is maintained at 6% for this FY 2012/13.

The bank rate, an ex-ante stance of monetary policy, is in between the band rate of 6 to 8 percentage points. The standing liquidity facility penal rate has been maintained at 3% for some years. The weighted average interest rate for T-bills (91 days) has touched 1.2% in July, 2012, whereas the interbank rate has touched a record 0.9% in July 2012, indicating excess liquidity in the economy. The major interest rates for the various years are given in the figure below:

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Figure 15
Trends in Policy Rate and Market Rate

(% per annum, mid-July)

Year	2006	2007	2008	2009	2010	2011	2012
A. Policy Rates							
CRR	5.0	5.0	5.5	5.5	5.5	5.5	5.0
Bank Rate	6.3	6.3	6.5	6.5	6.5	7.0	7.0
SLF Penal Rate	1.5	2.0	3.0	3.0	3.0	3.0	3.0
B. Government Securities							
T-bills (28 days)	2.4	2.13	5.16	4.94	8.70	8.08	0.1
T-bills (91 days)	3.25	2.77	5.13	6.80	8.13	8.52	1.2
T-bills (364 days)	4.04	4.00	6.47	6.55	7.28	8.61	2.7
C. Interbank Rate	2.13	3.03	3.61	3.66	6.57	8.20	0.9

Source: Nepal Rastra Bank.

5. Strengthening Financial Stability Indicators

The NRB is solely responsible for maintaining financial sector stability. Different strategies and policies are used to achieve this objective. Regulatory and supervisory measures are applied to maintain financial stability. The following are some of the strategies adopted by the NRB for financial sector management and stability:

1. Diversify financial sector through prudent and transparent licensing policy and enhance competitiveness in financial sector.

2. Broaden and deepen financial services, including micro-finance services for optimal outreach, and consolidate the banks and financial institutions.

3. Facilitate privatisation of public sector banks and financial institutions.

4. Develop the payment and settlement systems as per the international norms and standards while improving legal and regulatory framework compatible with international norms and standards.

5. Formulate the Financial Sector Master Plan for the banking and financial sector.

6. Strengthen proactive supervisory mechanism compatible with international norms and standards focused on risk-based supervision.

7. A cross-departmental team comprising the members from the Research Department, Bank Supervision Department, Development Bank Supervision Department, Finance Companies Supervision Department, Micro-finance

Supervision and Promotion Department, Foreign Exchange Management Department, Foreign Exchange Management Department and Regulation Department was formed in the NRB. The team was entrusted with the publication of the Financial Sector Stability Report. The team has submitted its first report to the Bank's management.

8. Quality Circles[3] are voluntarily being formed in the NRB. At present there are two quality circles. The first quality circle is working towards strengthening and revising the current FSIs and the second one is working towards monitoring and strengthening the macroeconomic stability.

6. Policy Recommendation

Financial stability indices covering deposit-takers and non-deposit takers, stock market, bond market, money market, insurance, etc., should be constructed to oversee the stability in the financial system reactively and proactively. A separate *Financial System Stability Statistics and Monitoring Department* in the NRB should be established to give more attention to addressing risks and promoting financial stability in Nepal. The consolidation and modernisation of banking and the strengthening of the supervisory capability and credit risk management should be the key priorities. Steps are needed to: (i) create a level regulatory playing field so as to allow private institutions to develop; (ii) improve the efficiency of the state-owned banks through strong governance and management structures; and (iii) better use development banks and micro-finance institutions to address the under-banked segments of the country. A Crisis Resolution Framework should be effectively formulated and activated for the resolution of crises. There should be a Memorandum of Understanding (MoU) and a Standing Working Committee of middle-level officers of regulators and supervisors of the financial system, namely from the NRB, Ministry of Finance, Insurance Board, Securities Board of Nepal and Office of Company Registrar, to create uniformity, certainty and stability in the regulatory and supervisory system. Some of the additional policy recommendations in this regard are as follows:

* Shadow banking practices have posed a challenge to the Nepalese banking system. It is estimated that 11% of the banking sector's deposits are being mobilised by cooperatives that are outside the NRB's jurisdiction. Shadow

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3. A quality circle is a volunteer group of employees from the same work area who meet together to discuss workplace improvement. The circle is empowered to promote and bring quality improvements through to fruition.

banking should be controlled. The financial activities of cooperatives should be brought under stringent regulatory and supervisory bodies.

- Ever greening (mismatch) of loan and under-reporting of NPL should be avoided by limiting overdraft loans. Loans and advances classified under 'others' heading should be reported in detail.

- E-Banking: With the rapid advancement in technology, the products and services of financial institutions have also been very technical and sophisticated. Along with the ease and convenience, e-banking services also pose various risks which may threaten the smooth functioning of the financial system. Though many financial institutions are offering these services, no regulation has been issued pertaining to e-banking. E-banking requires to be monitored stringently to avoid any problems.

- Multiple Banking Regulation: Multiple banking practices foster over-financing, while contributing to ever greening of loans both of which adversely affect the financial system. With the growing number of bank and financial institutions, multiple banking practices are also growing. Therefore regulation to streamline multiple banking practices should be developed.

- Licensing Policy: It has been witnessed that a large number of financial institutions are concentrated in certain areas, leading to unhealthy competition, thereby threatening financial stability. For balanced growth of the rural and urban areas, the NRB should adopt Differential Licensing Policy for rural and urban areas. Further revision should be made on the capital base, fit and proper test criteria, and income source verification is also needed. Different licensing policy is required for different class institutions.

- Coordination between different regulators of the financial system: There should be close coordination between the different regulators (NRB, SEBON, Cooperative Department) representing different component of the financial system in order to avoid conflicts as well as monitor the interconnected but diverse institutions within the financial system.

- Regulatory Forbearance: It has been witnessed that the NRB has granted regulatory forbearance to banks and financial institutions on various issues. Since forbearance only postpones the problems, the practice of granting regulatory forbearance should be discouraged.

- Establishment of Credit Rating Agency and Asset Management Company: Nepal has already implemented Basel II in terms of supervision, although in the simplified form. In order to move to an advanced form like "Risk-based Supervision", the establishment of a credit rating agency at the earliest is a must. Similarly, an asset management company should also be established upfront to expedite the quick sale of the non-banking assets.

7. Conclusion

The assessment of financial stability remains a crucial and indispensable task for every central bank. Like in many SEACEN economies, FSI indicators are not yet developed in Nepal. The Asian crisis of 1995 and the global financial crisis of 2008 re-emphasise the importance of central banks in crisis forecasting, preparedness and resolution and exposed the apparent absence of clear, wider mandate and capacity of maintaining financial stability. The NRB, the supervisor and regulator of the banking industry of Nepal, does not have clear policy statement of financial stability in its Act, but has continued its best efforts to maintain financial and monetary stability in Nepal. Macro-prudential analysis and stress testing have been found to be very useful in understanding vulnerabilities, but the availability of data and expertise should be strengthened. To assess the stability of the financial system and its most important segment, i.e. the banking sector, it is appropriate to use a number of quantitative indicators and combine the various approaches, including the calculation of financial soundness indicators, stress testing and some aggregate view of the development of the financial or banking sector based on a simple aggregate indicator.

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Chapter 6

**STRENGTHENING FINANCIAL STABILITY INDICATORS IN
THE MIDST OF RAPID FINANCIAL INNOVATION:
UPDATES AND ASSESSMENTS FOR SRI LANKA**

by
Dr. PKG Harischandra[1]

1. Introduction

Maintaining financial system stability has become a key policy priority, particularly in the aftermath of the recent global financial crisis. This is due to several reasons, which mainly include the enormous costs of financial crises and their increased frequency, the exponential growth in the volume of financial transactions, and the increased complexity of financial innovations. Policymakers now recognise that maintaining price stability is necessary, but certainly not sufficient to ensure macroeconomic stability. Further, the recent financial crisis has demonstrated that surveillance of microprudential indicators may also not be sufficient, unless adequate regard is paid to the interaction between microprudential surveillance and macro-financial indicators. Particularly, given the pace of innovations in financial markets and increasing integration among the capital markets, the traditional models of 'stress testing' were proved to be hardly adequate. At the same time, the costs of failure in the financial system encompassed not only the real economy, but also, enormous social and political costs have been experienced in many parts of the world. Hence, a consensus has now emerged to closely monitor the two way interaction between the financial sector and the real sector of the economy, by widening the scope of surveillance, while strengthening the existing financial stability indicators. This paper assesses the financial stability indicators in Sri Lanka in the context of their interlinkages to macroeconomic variables, given the steadily developing financial sector in Sri Lanka.

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2. Financial Stability Indicators

2.1 Macroprudential Indicators

The recent global financial crisis clearly demonstrated that financial system disruptions could easily destabilize the macroeconomy, through loss of output, increased unemployment, and overall decline in wealth effects. The supervision based on micro level indicators failed to identify systemic risk and, was unable to ensure that financial institutions had sufficient capital and liquidity to cope with a system wide shock. Therefore, identification of systemic risk is crucial for ensuring financial and macroeconomic stability. Identification of systemic risk needs to consider interlinkages and common exposures across the financial system, while recognizing the procyclicality of financial system (Caruana, 2010). Macroprudential indicators can provide a broader and system-wide perspective in identifying systemic risk to financial stability. As the working group reporting to the Committee on the Global Financial System (CGFS) highlights "[p]olicymakers broadly agree that the purpose of macroprudential policy is to reduce systemic risk, strengthening the financial system against shocks and helping it to continue functioning stably without emergency support on the scale that was extended in the [recent global financial]crisis" (CGFS, 2010). In the aftermath of the recent global financial crisis, most central banks and relevant government authorities have paid a lot of attention to macroprudential policy, while using a variety of tools to promote the resilience of the financial system.

2.2 Structure of the Financial System

The financial system in Sri Lanka comprises financial institutions, financial markets, and the financial infrastructure. The major financial institutions in Sri Lanka include the Central Bank of Sri Lanka which is the apex financial institution, Licensed Commercial Banks (LCBs), Licensed Specialised Banks (LSBs), Registered Finance Companies (RFCs), Specialised Leasing Companies (SLCs), Primary Dealers (PDs), pension and provident funds, insurance companies, rural banks, merchant banks, unit trusts and thrift and credit co-operative societies. The financial markets include the foreign exchange market, money market, capital market and the informal financial market, while the financial infrastructure comprises the legal framework related to the financial system and the payment and settlement system.

The banking sector in Sri Lanka, which includes 24 LCBs (12 domestic and 12 foreign) and 9 LSBs, continues to dominate the financial system. As Table 1 shows, the total assets in the deposit taking institution account for about 60

percent of the financial sector assets as at end 2011, while pension and provident funds hold about 17 percent, and insurance companies and leasing companies account for 3.4 percent and 1.8 percent, respectively. The single most important category of financial institution within the banking sector is the LCBs with a market share of 44 percent of the entire financial system's assets and 84 percent of banking sector's assets as at end 2011. The systemic importance of the LSB sector is relatively low in comparison to the LCBs, as it accounts for only 9 percent of the financial system's assets and 16 percent of the banking sector's assets. Despite a large number of licensed banks in the country, performance and financial strength of six LCBs stand out, which are referred to as Systemically Important Banks (SIBs). They consist of two state banks and four largest domestic private commercial banks. Collectively, SIBs account for 76.3 percent of the LCB sector assets and 64 percent of the banking sector assets. Thus, the stability of the financial system is mainly dependent upon the soundness of the SIBs, the failure of which may affect the confidence of the entire financial system, leading to a systemic risk. At present, there are 38 Registered Finance Companies (RFCs) and 18 Specialised Leasing Companies (SLCs) representing the non-bank financial sector.

The superannuation funds account for 17 percent of financial sector assets. This sector is dominated by the Employee Provident Fund, which accounts for nearly 13 percent of financial sector assets. The next largest pension fund is the Employees Trust Fund, which manages just 2 percent of financial system assets. In addition, there are around 185 approved provident funds assets of which represent only about 2 percent of the assets in the total financial system.

Table 1

Assets Structure of the Financial System in Sri Lanka

Financial Institution	% Share As at end 2011(a)
Central Bank of Sri Lanka	**14.6**
Institutions Regulated by the Central Bank	**63.2**
Deposit Taking Institutions	59.6
Licensed Commercial Banks	46.4
Licensed Specialized Banks	8.7
Licensed Finance Companies	4.6
Other Financial Institutions	3.5
Primary Dealers	1.8
Specialized Leasing companies	1.8
Institutions not Regulated by the Central Bank	**22.2**
Deposit Taking Institutions	0.9
Rural Banks (b)	0.7
Thrift and Credit Co-operative Societies (b)	0.1
Contractual Savings Institutions	20.4
Employees' Provident Fund	13.2
Employees' Trust Fund	1.8
Approved Private Provident Funds (c)	1.5
Public Service Provident Fund	0.4
Insurance Companies (d)	3.4
Other Financial Institutions	0.8
Stock Broking Companies (e)	0.1
Unit Trusts/ Unit Trust Management Companies (e)	0.3
Market Intermediaries* (e)(f)	0.3

(a) Provisional
(b) Registered with the Department of Co-operative Development.
(c) Registered with the Department of Labour.
(d) Regulated by the Insurance Board of Sri Lanka.
(e) Regulated by the Securities and Exchange Commission of Sri Lanka.
(f) Market Intermediaries include Underwriters, Margin Providers and Investment Managers.
* Excluding the assets of Licensed Banks, Licensed Finance Companies and Specialized Leasing Companies which are registered as Market Intermediaries.
Source: Central Bank of Sri Lanka.

In the insurance sector, there are currently 19 insurance companies registered by the Insurance Board of Sri Lanka (IBSL). Of these, 12 companies are composite insurers engaged in both long-term and general insurance business, while 5 companies are in the general insurance business only and 2 companies are in long-term insurance business. There are also 7 insurance companies that are listed on the Colombo Stock Exchange (CSE).

2.3 Indicators for Macroprudential Surveillance

2.3.1 Aggregated Microprudential Indicators/Market Based Indicators

As described, policymakers, over the years, have been working on better statistics to evaluate financial system vulnerabilities, resulting in the development of 'macroprudential indicators'. These indicators are now widely identified as Financial Soundness Indicators (FSIs). FSIs are "indicators compiled to monitor the health and soundness of financial institutions and markets, and of their corporate and household counterparts. FSIs include both aggregated information on financial institutions and indicators that are representative of markets in which financial institutions operate" (Sunadrarajan et al., 2002). Because FSIs cover a broad range of elements, the number of indicators available for surveillance has increased significantly over time. However, the relevance of each individual indicator may depend on country specific factors, hence, may vary from country to country. Therefore, policy attention has focused on the overall structure and economic situation of a country and the financial system, in basing the assessment needs of financial system stability. The IMF has proposed two sets of indicators which provide a considerable degree of flexibility in selecting the most relevant indicators for assessing vulnerability factors. The *core set* includes indicators for the banking sector that should have priority in compilation and monitoring of FSIs, while the *encouraged set* includes the additional indicators for the banking sector as well as other financial institutions and markets relevant in the assessment of financial vulnerability.

Annex I provides the list of indicators that fall under core and encouraged sets. In fact, depending on the level of financial development of a country and its institutional structure and other country specific factors, indicators of the core set could be used with selected additional indicators from the encouraged list.

These FSIs are primarily derived by aggregating indicators of financial health of individual institutions. A framework used more traditionally in analyzing the financial health of institutions is CAMELS which employs six groups of indicators, namely, capital adequacy, asset quality, management soundness, earnings, liquidity, and sensitivity to market risk. Another aspect which is not included in the six-group CAMELS approach is the market-based assessments of the financial sector (Evans et al., 2000). While the sensitivity to market risk involves elements of risk due to interest rate, exchange rate, equity price and commodity price, market-based assessment of the financial sector involves indicators such as market

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prices of financial instruments, including equity; indicators of excess yields; credit ratings; and sovereign yield spreads. In the context of the recent global financial crisis, these indicators have been widely included in the assessment of risks posed by the global financial system. Annex II provides a summary of FSIs for the banking sector in Sri Lanka during 2006-2011.

2.3.2   Macroeconomic Variables and their Impact on FSIs

Macroeconomic developments and the operations of financial institutions are inter-dependent. Hence, financial soundness indicators need to be assessed in the context of overall macroeconomic performance. Table 2 provides a summary of key macroeconomic variables that have an impact on financial soundness indicators (see Evans et al., 2000 for details).

Table 2
Key Macroeconomic Variables and Their Impact on FSIs

Key Macroeconomic Variables	Impact on the Financial Soundness Indicators
Economic Growth	
Aggregate Growth Rates	Declining aggregate growth rates tend to weaken the debt-servicing capacity of borrowers and contribute to increasing credit risk
Sectoral Slumps	Some sector specific shocks, particularly, where financial institutions' loans and investments are concentrated on, could deteriorate the quality of portfolios and profitability margins, thus, lowering the cash flow and reserves of financial institutions
Balance of Payments	
Current Account Deficit	A larger current account deficit could exert pressure on the exchange rate, thus signaling vulnerability to a currency crisis. A larger current account deficit financed by short-term portfolio capital may lead to a 'capital flight' resulting in negative implications for liquidity of the financial system. Further, if the current account deficit is largely financed by external capital inflows, that could lead to asset price and credit booms
Reserves and External Debt	The ratio of international reserves to short-term liabilities is a key indicator of the external sector stability of a country. A fall in this ratio can lead to a currency crisis as the demand for foreign exchange for import expenditure may not be met
Terms of Trade	A large deterioration of the terms of trade is a vulnerability indicator for countries with a high degree of openness. For instance, small economies with a large

Key Macroeconomic Variables	Impact on the Financial Soundness Indicators
	export concentration could be vulnerable to banking crises due to a deterioration in the terms of trade; while a substantial improvement in the terms of trade could result in asset price bubbles
Composition and Maturity of Capital Flows	Potential vulnerability indicators may derive from factors such as short-term verses long-term capital flows, official verses private capital flows etc.
Inflation	
Volatility in Inflation	Inflation volatility could have significant real effects due to its impact on the information base of financial institutions, and resulting difficulty in making accurate assessment of credit and market risk
Interest and Exchange Rates	
Volatility in Interest and Exchange Rates	Volatility in domestic and international interest rates could affect the financial system both directly (if interest rate risk cannot be mitigated) and indirectly (through deterioration of credit quality). Volatility in exchange rate may result in currency mismatches between bank assets and liabilities
Level of Domestic Real Interest Rates	Higher level of real interest rates could result in increased non-performing loans, while negative real interest rates could signal financial system distortions
Exchange Rate Sustainability	A large real appreciation in the exchange rate could erode external sector competitiveness, thus weakening the debt servicing of exporters. Conversely, a large depreciation of the real exchange rate could weaken non-export related domestic borrowers
Lending and Asset Price Booms	
Lending Booms	An excessive increase in bank credit could lead to severe financial crisis due to likely low quality credit appraisals and possible weaknesses in the repayment capacity of borrowers
Asset Price Booms	Expansionary monetary and fiscal policies could lead to bubbles in asset prices including real estate markets
Contagion Effects	
Trade Spillovers	A significantly depreciated currency would have negative spillover effects on competing trading partners
Financial Markets Correlation	More closely linked financial markets could easily convert idiosyncratic shocks into systemic shocks

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2.3.3   Stress Tests and Scenario Analysis

The Central Bank of Sri Lanka (CBSL) employs an econometric model to evaluate credit risk in the banking sector. The model examines the impact of macroeconomic variables on asset quality of the banking sector. Specifically, the model uses non-performing loans (NPL) as a proxy for asset quality which is regressed on GDP growth rate, unemployment rate, and average weighted lending rate. The model derives expected signs, showing a negative relation between NPL and GDP growth and a positive relation between NPL and the unemployment rate and average weighted lending rate. The model is then used for scenario analysis to forecast the gross NPL under different scenarios with regard to regressors used (see CBSL's Financial System Stability Report -2011, Box Article 2 for details).

2.3.4   Qualitative Information on Institutional and Regulatory Framework

The CBSL, with its dual mandate for the maintenance of economic and price stability and financial system stability, regulates and supervises the key categories of financial institutions in order to ensure stability in key financial markets and institutions. Further, the CBSL conducts regular surveillance of the financial system, while overseeing the payments and settlements system. The financial system of the country is regulated by several legislative enactments. The key Acts relevant to the regulatory role of the Central Bank are the Monetary Law Act, Banking Act, Finance Business Act, Finance Leasing Act, Payment and Settlement Systems Act and Financial Transactions Reporting Act, Local Treasury Bills Ordinance, Registered Stocks and Securities Ordinance, Exchange Control Act.

The regulation and supervision of banking institutions is mainly governed by the Monetary Law Act No.58 of 1949, the Banking Act No.30 of 1988 and the Exchange Control Act No. 24 of 1953. The regulation and supervision of finance companies is undertaken in terms of the Finance Business Act, No 42 of 2011. The regulation and monitoring of finance leasing establishments is conducted under the Finance Leasing Act No.56 of 2000. The regulation of supervision of primary dealers in government securities is carried out in terms of the Local Treasury Bills Ordinance No.8 of 1923 and the Registered Stocks and Securities Ordinance No.7 of 1937.

The regulatory and supervisory function relating to banking institutions is carried out by the CBSL. Under the off-site surveillance system, the financial

condition of Licensed Commercial Banks and Licensed Specialised Banks is monitored on the basis of periodic information provided by banks on their operations. The periodic information includes weekly interest rates of deposits and advances, monthly returns on selected financial information, assets and liabilities, statutory liquid assets, quarterly ret   urns on income and expenditure, capital adequacy, non-performing advances, classified advances and provisioning for bad and doubtful advances, and investments in shares. In addition, information on accommodation granted to bank directors, their close relations and concerns in which a director has a substantial interest, interest spreads, half-yearly return on share ownership of the banks and annual audited financial statements is also provided. With regard to on-site surveillance, the risk based examination process is carried out, which focuses on identification of banking risks, the management of these risks and the assessment of adequacy of resources to mitigate these risks. In addition, a bank's compliance with statutory requirements, applicable laws and regulations, internal controls and the standards of corporate governance are assessed. Matters relating to non-compliance with prudential requirements and any weaknesses and deficiencies in the financial condition, controls and systems of a bank are brought to the notice of its Board of Directors to ensure that corrective action is taken by the bank.[2]

The supervision of non-bank financial institutions is also carried out through off-site surveillance and on-site examinations. The directions and rules issued under the provisions of the Finance Companies Act cover minimum capital adequacy and liquidity requirements, provisioning for bad and doubtful debts, single borrower limits and limits on equity investments. Matters relating to non-compliance with prudential requirements and any weaknesses and deficiencies in the financial condition, controls and systems of a finance company are brought to the notice of its Board of Directors to ensure that corrective action is taken by the finance company.

3.   Literature Review

3.1 Theories of Financial Instability

Theories of financial instability highlight several potential problems caused by asymmetric information. The problem of asymmetric information may be defined as "a situation in which one party to a financial transaction has superior information to another, because it is costly to gather information" (Johnston et

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2.   More details are available in the CBSL website: http://www.cbsl.gov.lk.

al., 2000). Most of the theories on financial instability focus on the financial intermediaries, which arise as a particular solution to the problem of asymmetric information. However, the financial intermediaries too do not possess perfect information, hence, what they do is reducing information asymmetry, rather than eliminating it completely, thus explaining elements of instability existing within the financial system. Further, the institutional form of intermediaries may also be a source of financial instability, because the intermediary assets are generally less liquid than liabilities. In what follows, we briefly describe the potential problems caused by asymmetric information as highlighted in the literature.

The problem of *adverse selection* occurs in the financial market where lenders have trouble in distinguishing between 'good risk' and 'bad risk' borrowers, i.e., determining whether a borrower has good investment opportunities with low risk or, alternatively, has poorer investment projects with high risk. In such cases, the lender may only make the loan at an interest rate that reflects the average quality of the good and bad borrowers. The result is that high-quality borrowers pay a higher interest rate than they should, and low-quality borrowers pay a lower interest rate than they should. Eventually, some high-quality borrowers may drop out of the market. On the other hand, because adverse selection in financial markets could lead to the belief that most securities offered for sale are of substandard quality, hence such a belief will result in uncertainty about asset values, a flight to quality, and ultimately result in market freezes and liquidity hoarding, propagating the impact on the entire financial system. In the presence of asymmetric information and resulting adverse selection, a small increase in the 'riskless' interest rate can lead to a large reduction in lending and possibly even a collapse in the market (Mankiw, 1986). Further, the problem of adverse selection may cause banks to impose credit rationing-putting quantitative limits on lending to some borrowers. As Mishkin (1991) asserts, if increased demand for credit or a decline in the money supply drives up the interest rates, the adverse selection problem may be severely worsened, leading to a significant decline in lending and subsequently a substantial fall in investment and economic activity.

The issue of *moral hazard* is where agents do not bear the full costs or benefits of their actions and thus have the incentive to take on additional risk. Examples include - a mortgage company selling a mortgage to a buyer; or paying excessive bonuses out of funds managed on someone else's behalf. As Mishkin (1991) indicates, because lenders have trouble in ascertaining the quality of investment projects that borrowers wish to undertake, the borrower has incentives to engage in activities that may be personally beneficial but will increase the probability of default and thus harm the lender. For example, the borrower has

incentives to invest in projects with higher risk, in which the borrower does well if the project succeeds but the lender bears most of the loss if the project fails. Also, Lane and Phillips (2000) distinguish between *creditor-side* and *debtor-side* moral hazard in the context of international bailouts. The creditor-side moral hazard relates to the prospects of international bailouts in the event that difficulties may have led creditors to be less discriminating, leading to larger credits at lower spreads, while the debtor-side moral hazard relates to the possibility of recourse to funding facilities which may have diminished the incentive for borrowers to have followed prudent policies.

The *free-rider problem* occurs when an agent that collects information about a particular risk is unable to prevent other agents from using that information, and thus being unable to appropriate the full benefits of collecting the information. In financial markets, this gives rise to a situation where investors in large numbers have little incentive to devote resources to the monitoring of financial institutions more closely, thus tending to use the information available at large, instead. As Mishkin (1996) describes, because of free-riding, investors who acquire information may not be able to make the extra earning from securities from the additional information, so that, the ability of firms which make profit from producing additional information is weakened, resulting in less information being produced in securities markets.

The *principal-agent and monitoring problems* occur when an agent has different incentives than the person he works for (i.e., the principal), and so acts in his own interest rather than in the interest of the principal. Further the principal cannot observe perfectly the actions of the agent to whom the principal delegates a certain activity or responsibility. For example, regulators in the financial sector are ultimately agents for taxpayers (principals). The principal-agent problem occurs because the regulator may not have the same incentive to minimise costs to the economy as the taxpayer (Mishkin, 1996).

The problem of *rational herding* occurs where agents react to information on the decisions of other agents in the market rather than information on the underlying transactions themselves. As Devenow and Welch (1996) describe, rational herding models are typically built on one or more of three effects: (a) payoff externalities models where the payoffs to an agent adopting an action increases in the number of other agents adopting the same action (Diamond and Dybvig, 1983); (b) principal-agent models where the managers, in order to preserve or gain reputation when markets are imperfectly informed, may prefer either to 'hide in the herd' not to be evaluable, or to 'ride the herd' in order to prove quality (Rajan,1994); and (c) cascades models where the later agents,

inferring information from the actions of prior agents, optimally decide to ignore their own information and act alike (Corb,1993; Chen, 1995).

The *contagion* problem is where a shock in one asset market affects prices in other asset markets. The recent Euro zone crisis, the US sub-prime mortgage crisis of 2007/08, the Mexican crisis of 1995, the Asian crisis of 1997/98, the sharp depreciation of the Brazilian real in 1999-have been accompanied by episodes of financial markets contagion in which many countries have experienced increases in the volatility and co-movement of their financial asset markets. Several studies discuss financial instability associated with contagion such as Agenor and Aizenman (1998), Corsetti, Pesenti and Roubini (1999), Kaminsky and Reinhart (2000), among others.

3.2 Evolution of Literature on Micro- and Macro-Prudential Indicators

This section briefly discusses the literature in general on micro and macro-prudential indicators. The earlier literature on aggregated microprudential indicators mainly followed the categorisation of the CAMELS rating (IMF, 2000), and it was largely based on multivariate data analysis using a set of financial and economic ratios, as possible determinants of corporate failures (Sori and Jalil, 2009). For example, Altman (1968) who studied the prediction of corporate failures used twenty-two ratios from five categories, namely, liquidity, profitability, leverage, solvency and activity; and examined sixty-six corporations from manufacturing industries comprising bankrupt and non-bankrupt firms (see also Rushinek and Rushinek, 1987). More recent literature on aggregated microprudential indicators expanded the scope to other aspects such as degree of exposure to currency and inflation risks. Examples include Frankel and Rose (1996), among others, which examines external variables such as the over-valuation of currency, the current account and the level of indebtedness and the composition of the debt etc. (see also Sachs et al., 1996; Honohan, 1997). Also, some studies examined the level of non-performing loans within the context of CAMELS framework, and asserted that this framework renders statistically significant results only if capital adequacy and non-performing loans are considered simultaneously (González -Hermosillo, 1999).

While the microprudential indicators measure the risks of individual institutions in isolation -*idiosyncratic risk,* the macroprudential indicators focus on the factors that could affect the stability of the financial system in its entirety - *systemic risk*. A summary of the differences in these perspectives is given in the table below.

Table 3
Comparison of the Macro- and Micro-prudential Perspectives

	Macroprudential	Microprudential
Proximate objective	Limit financial system-wide distress	Limit distress of individual institutions
Ultimate objective	Avoid output (GDP) costs	Consumer(investor/depositor) protection
Model of risk	(in part) endogenous	Exogenous
Correlations and common exposures across institutions	Important	Irrelevant
Calibration of prudential controls	In terms of system-wide distress; top-down	In terms of risks of individual institutions; bottom-up

Source: Borio (2003).

The term 'macroprudential' dates back to late 1970s, with concerns over international lending, and since then has denoted concerns over the financial system's stability and how it is linked with the macroeconomy. However, the specific focus of those concerns has changed over time. For example, in late 1980s, the focus has been more towards how financial innovation may raise risks for the financial system as a whole. By late 1990s, the term has more often been used, particularly, with the Asian financial crisis in 1997, leading to the development of so-called "macroprudential indicators" by the IMF in 1998. Meanwhile, in 2000, a renewed prominence was given to the term 'macroprudential' over the concerns about the impact of rapid financial innovation and the development of capital markets, and also the influence of regulation on the procyclicality of the financial system (Clement, 2010). Further, in late 2000s, in the aftermath of the global financial crisis, there has been a renewed interest in the term 'macroprudential' due to concerns over the failure of systemically significant institutions.

4. Aggregated Microprudential Indicators

4.1 Specification of Aggregated Microprudential Indicators

4.1.1 FSIs for Banking Sector

The financial performance of the banking sector, registered finance companies, and specialised leasing companies improved substantially despite

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challenges faced from internal as well as external factors. As Figure 1(a) – 1(d) show, all key financial soundness indicators which include capital-based, asset-based, and profitability have improved. Please refer to Annex III for graphical representation of FSIs for Registered Finance Companies and Specialised Leasing Companies.

Figure 1(a)
Capital-based FSIs for Banking Sector
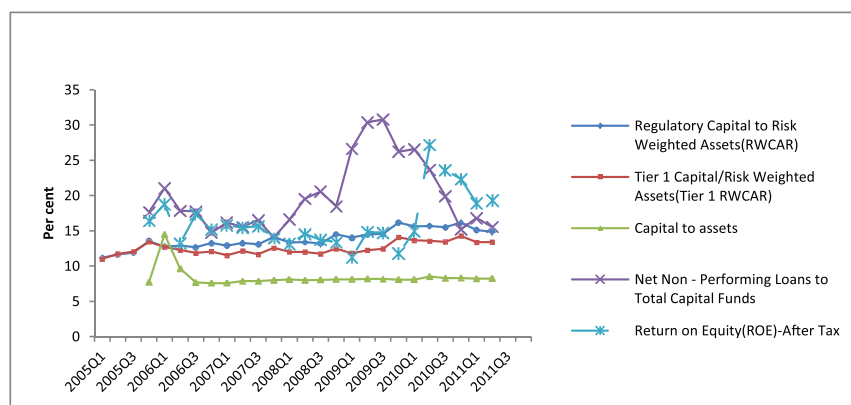
Source: Central Bank of Sri Lanka.

Figure 1(b)
Asset-based FSIs for Banking Sector
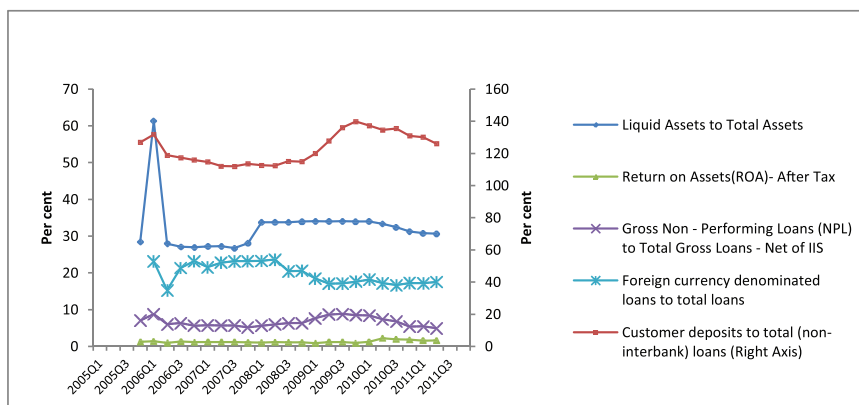
Source: Central Bank of Sri Lanka.

Figure 1(c)
Asset-based FSIs for Banking Sector
(Sectoral Distribution of Loans to Total Loans)
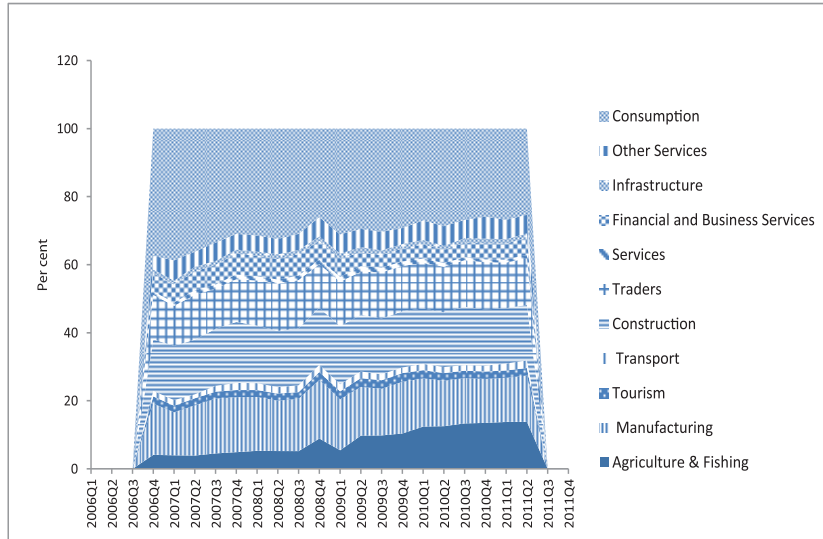
Source: Central Bank of Sri Lanka.

Figure 1(d)
Income- and Expense-based FSIs for Banking Sector
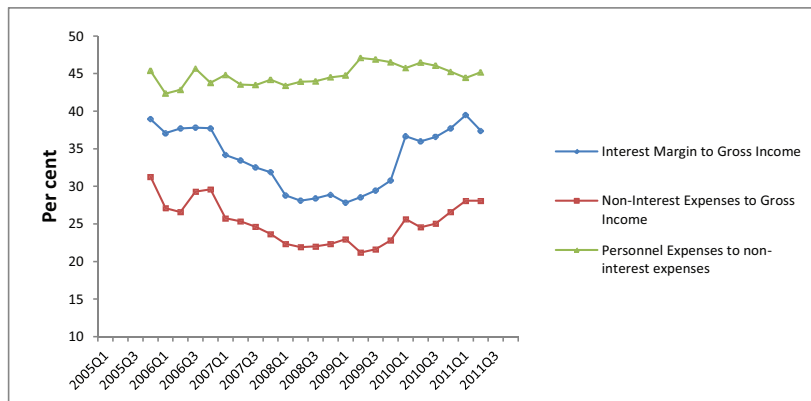
Source: Central Bank of Sri Lanka.

4.2 Specification of Macroeconomic/Market Variables

This section examines the relationship between FSIs and the business cycle using simple correlation relationships, as well as econometric methodology, in that, FSIs are modeled as a function of macroeconomic and structural variables. We measure the business cycle as the cyclical component of real GDP, extracted from the Hodric-Prescott filter. The generated cyclical component shows deviation of actual real GDP growth from the trend level. A positive value implies economic expansion above the trend level, while a negative value implies economic contraction compared to trend level. Our choice of business cycle measure is limited due to data availability, as other techniques such as Baxter-King filter and Christiano-Fitzgerald filter truncate date from both ends.

Figure 2 illustrates the relationship between FSIs and business cycle, which is measured on the horizontal axis. As shown in Figure 2(a), FSIs for commercial banks exhibit variation with the business cycle, where the relationship is stronger in the case of capital adequacy and profitability indicators (namely, regulatory capital to risk weighted assets; Tier 1 capital to risk weighted assets; and return on assets (ROA); return on equity (ROE), respectively), while the relationship is weak with regard to asset quality indicator (non-performing loans (NPL) to total capital funds). In particular, capital adequacy and profitability indicators clearly appear to be procyclical, i.e., when economy performs below the trend level, these indicators fall, and vice versa. As expected, NPLs to total capital funds appear to be countercyclical, however, NPLs to total gross loans are procyclical.

Figure 2(b) shows FSIs for registered finance companies, where the relationships are a bit ambiguous, particularly, with regard to capital adequacy and asset quality indicators. The capital adequacy indicators appear to behave countercyclically, while asset quality indicators (NPLs to total capital funds and NPLs to total gross loans) appear to be procyclical. Meanwhile, profitability indicators are procyclical as expected. These preliminary findings imply that FSIs vary substantially with the business cycles, however, the relationships between FSIs and business cycle across different sectors in the financial system are heterogeneous.

Figure 2(c) shows FSIs for specialised leasing companies, where the relationships are clear cut with regard to profitability indicators, in that, both ROA and ROE behave procyclically. However, the asset quality indicator, NPLs to total gross loans appears to be weakly related to business cycle movements.

These preliminary findings imply that FSIs vary substantially with the fluctuations in the business cycle, thus, analysis of FSIs requires taking into account of the phase of the business cycle. However, the relationships between FSIs and business cycle across different sectors in the financial system tend to be heterogeneous, implying the sector specific factors play a substantial role, warranting a close monitoring of them.

Figure 2(a)
FSIs and Business Cycle 2005q1-2011q2 (Banks)
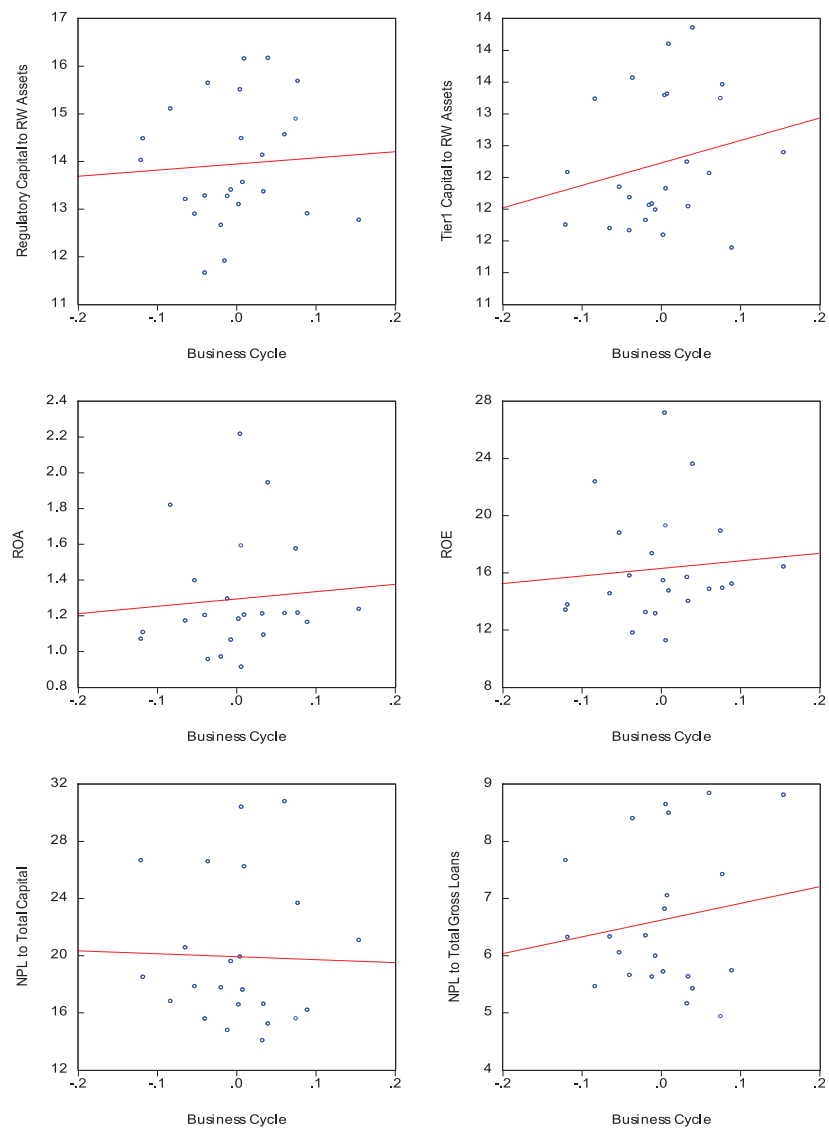
Figure 2(b)
FSIs and Business Cycle 2005q1-2011q2
(Registered Finance Companies)
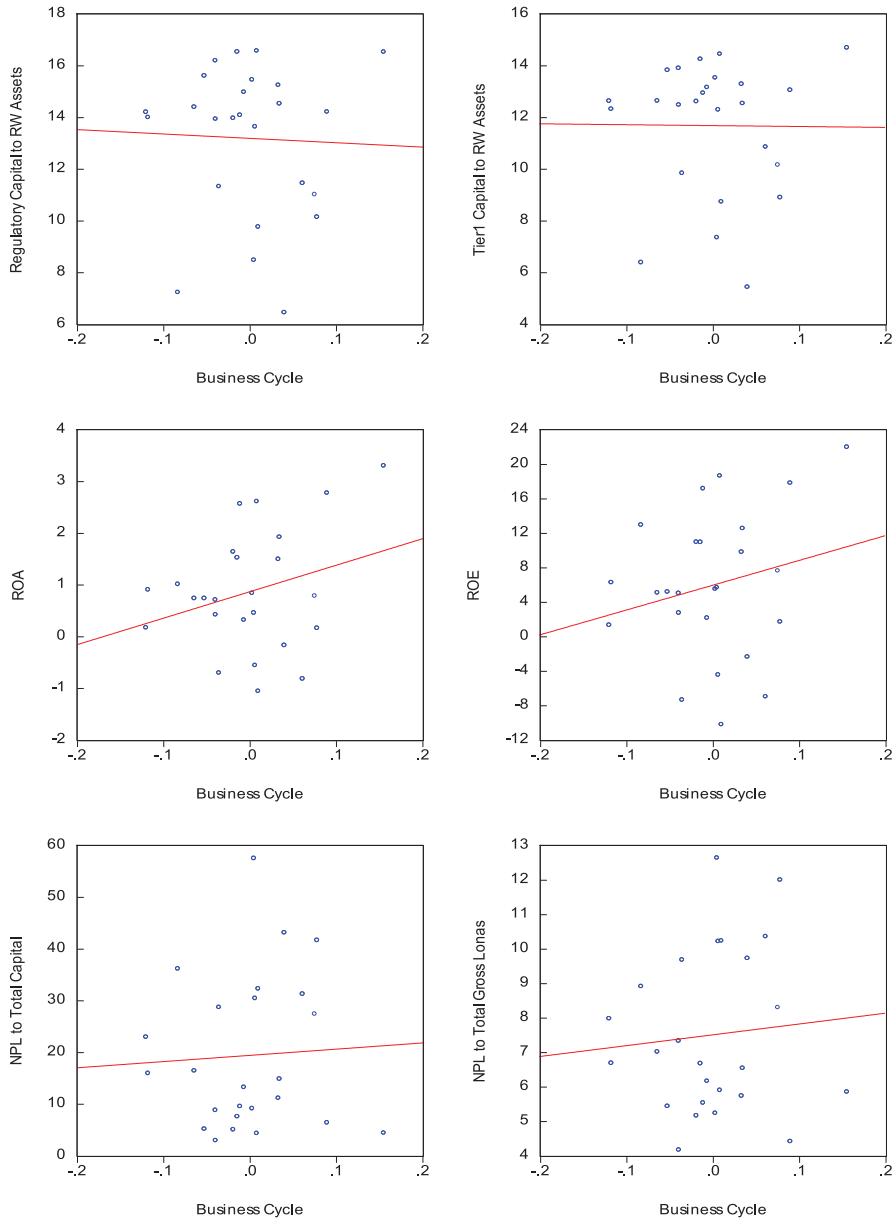
Figure 2(c)
FSIs and Business Cycle 2005q1-2011q2
(Specialised Leasing Companies)
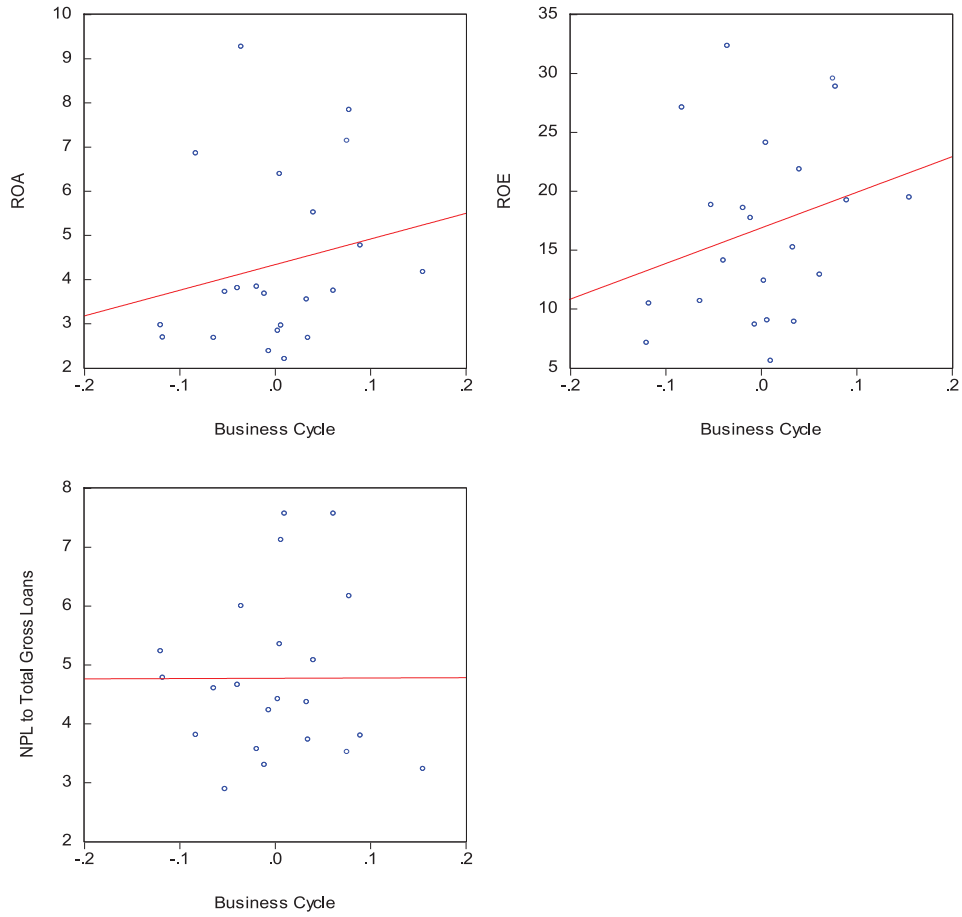
4.3 Modeling Relationship between FSIs and Macroeconomic Data

This section describes, using econometric models, the relationship that key FSIs, such as capital adequacy, asset quality, and profitability have with macroeconomic data.

4.3.1 Capital Adequacy

We model observed changes in the capital ratio as a function of lagged capital ratio, the business cycle, changes in inflation rate, the real effective exchange rate, and real interest rate (see Shreives and Dhal, 1992; Babihuga, 2007). The model is expected to capture any discretionary adjustment towards the target capital ratio, as well as, the exogenous macroeconomic factors.

The following specification is used to estimate the determinants of changes in the capital ratio:

$$\Delta capital_t = \alpha_1 + \alpha_2 capital_{t-1} + \alpha_3 bcycle_{t-i} + a_4 inf_{t-i} + \alpha_5 reer_{t-i} + \alpha_6 r\_int_{t-i} + \varepsilon_t$$

where $capital_t$ is the capital to risk weighted assets ratio, $bcycle_t$ is business cycle component of real GDP growth, inf_t is change in inflation rate, $reer_t$ is change in real effective exchange rate (an increase is defined as appreciation), and r_int_t change in real interest rate. Further, Δ denotes difference operator, and ε_t is error term. Data sample is 2005q1 through 2011q2, i denotes the lag structure which is chosen based on Akaike information criterion. The model is a dynamic specification as the capital ratio at time t, is likely to be related to its level in previous periods. The estimation results are reported below.

Table 4(a)
Estimation Results of the Determinants of
Changes in Capital Ratio (Banks)

Dependent Variable: D(CAP)
Method: Least Squares
Sample (adjusted): 2006Q2 2011Q2
Included observations: 21 after adjustments
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.623095	1.046583	3.461832	0.0035
CAP(-1)	-0.240358	0.069885	-3.439349	0.0037
CYCLE(-2)	-0.312204	1.099524	-0.283945	0.7803
D(INF(-2))	-0.267015	0.112470	-2.374107	0.0314
D(REER(-4))	-0.150052	0.028237	-5.313978	0.0001
D(RIR(-2))	-0.183839	0.101594	-1.809544	0.0904

R-squared	0.706584	Mean dependent var	0.101184
Adjusted R-squared	0.608779	S.D. dependent var	0.660013
S.E. of regression	0.412823	Akaike info criterion	1.303361
Sum squared resid	2.556342	Schwarz criterion	1.601796
Log likelihood	7.685286	Hannan-Quinn criter.	1.368129
F-statistic	7.224395	Durbin-Watson stat	2.133020
Prob(F-statistic)	0.001259		

Table 4(b)
Estimation Results of the Determinants of Changes in
Capital Ratio (Registered Finance Companies)

Dependent Variable: D(REG_CAP_RFC)
Method: Least Squares
Sample (adjusted): 2006Q2 2011Q2
Included observations: 21 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	2.681519	1.362564	1.967994	0.0678
REG_CAP_RFC(-1)	-0.236694	0.103593	-2.284848	0.0373
CYCLE(-2)	-0.716650	5.003385	-0.143233	0.8880
D(INF(-2))	0.593759	0.214459	2.768641	0.0143
D(REER(-4))	0.157661	0.088474	1.782006	0.0950
D(RIR(-2))	0.473430	0.202612	2.336631	0.0337

R-squared	0.429964	Mean dependent var	-0.262144
Adjusted R-squared	0.239952	S.D. dependent var	1.404201
S.E. of regression	1.224193	Akaike info criterion	3.477397
Sum squared resid	22.47972	Schwarz criterion	3.775832
Log likelihood	30.51266	Hannan-Quinn criter.	3.542165
F-statistic	2.262823	Durbin-Watson stat	1.662440
Prob(F-statistic)	0.101170		

These estimates show dynamic short-run relationships between capital ratio and the explanatory variables. The coefficient on lagged capital ratio is negative and statistically significant, implying that any deviation of the capital ratio from the target level does not get corrected instantaneously. In particular, the estimate of -0.24 reveals, on average, capital ratio takes about a year to adjust from a disequilibrium that occurred in the past. The business cycle has a negative correlation with the capital ratio when using regulatory capital, while the correlation is positive with Tier 1 capital. However, both coefficients are statistically insignificant. Yet, a negative correlation between business cycle and capital adequacy ratio may imply that in economic downturns banks hold more capital as a precautionary measure. Meanwhile, inflation, real effective exchange rates, real interest rates have strong and statistically significant negative correlation with capital ratio. Higher inflation and interest rate may have a negative impact on profits, thus, deteriorating the capital ratio. Also, a real exchange rate appreciation may affect the capital ratio negatively. However, we do not have a robust priori of the effect of these three explanatory variables on the capital ratio. For example, the effect of inflation on capital ratio depends on the impact of high inflation on bank profits, while, the effect of real exchange rate fluctuations on the capital ratio depends on the share of assets held abroad. Similarly, the impact of interest rate fluctuations on the capital ratio depends on the degree of pass-through to deposit rates vis-à-vis lending rates.

4.3.2 Asset Quality

We define asset quality as the share of non-performing loans to total loans, and model it as a function of macroeconomic variables including business cycle, inflation, real effective exchange rate real interest rate, terms of trade (to represent any impact on borrowing sectors).

The following specification is used to estimate the determinants of asset quality:

$$npl_t = \alpha_1 + \alpha_2 bcycle_{t-1} + \alpha_3 inf_{t-i} + a_4 reer_{t-i} + \alpha_5 r\_int_{t-i} + \alpha_6 tot_{t-i} + \varepsilon_t$$

where npl_t is the gross non-performing loans to total gross loans, tot_t is terms of trade, defined as the ratio of export and import unit value indexes. Other variables are as defined above. Here the interest rate taken is the weighted average prime lending rate (AWPR). The estimation results are reported below.

Table 5(a)
Estimation Results of the Determinants of Asset Quality (Banks)

Dependent Variable: NPL_L
Method: Least Squares
Sample (adjusted): 2006Q2 2010Q4
Included observations: 19 after adjustments
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.433558	0.198454	32.41837	0.0000
CYCLE(-1)	-1.196925	3.469409	-0.344994	0.7356
D(INF(-1))	-0.205899	0.045036	-4.571858	0.0005
D(REER(-1))	0.048746	0.047356	1.029335	0.3221
D(R_AWPR(-4))	0.232703	0.045501	5.114223	0.0002
D(TOT(-1))	-0.375993	1.919058	-0.195926	0.8477

R-squared	0.679038	Mean dependent var	6.643105	
Adjusted R-squared	0.555591	S.D. dependent var	1.213128	
S.E. of regression	0.808720	Akaike info criterion	2.665361	
Sum squared resid	8.502365	Schwarz criterion	2.963605	
Log likelihood	-19.32093	Hannan-Quinn criter.	2.715836	
F-statistic	5.500641	Durbin-Watson stat	1.228410	
Prob(F-statistic)	0.006163			

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Table 5(b)
Estimation Results of the Determinants of Asset
Quality (Registered Finance Companies)

Dependent Variable: NPL_L_RFC
Method: Least Squares
Sample (adjusted): 2006Q2 2011Q2
Included observations: 21 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.641878	0.616802	12.38952	0.0000
CYCLE(-2)	-5.040117	11.26095	-0.447575	0.6605
D(INF(-1))	-0.183068	0.190160	-0.962701	0.3500
D(REER(-1))	0.026943	0.148588	0.181326	0.8584
D(R_AWPR(-4))	0.135275	0.163744	0.826133	0.4209

R-squared	0.137239	Mean dependent var		7.719226
Adjusted R-squared	-0.078451	S.D. dependent var		2.522631
S.E. of regression	2.619714	Akaike info criterion		4.968264
Sum squared resid	109.8065	Schwarz criterion		5.216960
Log likelihood	-47.16678	Hannan-Quinn criter.		5.022238
F-statistic	0.636278	Durbin-Watson stat		0.227917
Prob(F-statistic)	0.644038			

As expected, the coefficient on the business cycle variable is negative, albeit statistically insignificant. The negative correlation implies that during economic booms, asset quality improves. There is strong evidence that interest rates worsen the asset quality, as given by positive and statistically significant coefficient of the AWPR. A higher inflation tends to improve the NPLs, which is a somewhat ambiguous result, and it is statistically insignificant. In fact, the effects of inflation on asset quality may depend on whether inflation is anticipated or not, in that, unanticipated inflation will deteriorate asset quality. A real exchange rate appreciation appears to worsen asset quality, while an improvement in terms of trade seems to have a positive impact on asset quality. The overall impact will depend on which effect dominates.

4.3.3 Profitability

Two widely used profitability measures are the Return On Equity (ROE) and Return On Assets (ROA). However, ROE is subject to criticism as it generally disregards the leverage risk (see Sundararajan et al., 2002). So, our preferred measure of profitability is ROA. In modeling the determinants of profitability, we include equity capital, operating cost (proxied by non-interest expenses to gross income), credit risk (proxied by asset quality indicator, i.e., gross non-performing loans to total gross loans), and the macroeconomic variables as specified above, which include, business cycle, inflation, real effective exchange rate, and interest rate (proxied by 91-day treasury bill rate).

The following specification is used to estimate the determinants of profitability:

$$roa_t = \alpha_1 + \alpha_2 capital_{t-i} + \alpha_3 npl_{t-i} + a_4 bcycle_{t-i} + \alpha_5 inf_{t-i} + \alpha_6 reer_{t-i} + \alpha_7 r\_int_{t-1} + \alpha_t ovhd_{t-i} + \varepsilon_t$$

where roa_t is return on assets to total assets ratio, $ovhd_t$ is a measure of overhead cost. Other variables are as defined above. The estimation results are reported below.

Table 6(a)
Estimation Results of the Determinants of Profitability (Banks)

Dependent Variable: ROA
Method: Least Squares
Sample (adjusted): 2006Q2 2011Q2
Included observations: 21 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.892157	0.711558	-2.659175	0.0197
CAP(-1)	0.220686	0.050390	4.379535	0.0007
D(NPL_L(-1))	-0.184964	0.088401	-2.092332	0.0566
CYCLE(-1)	0.778386	0.976225	0.797343	0.4396
D(INF(-1))	0.018474	0.049548	0.372856	0.7153
D(REER(-1))	0.044650	0.014517	3.075703	0.0089
D(RIR(-1))	0.017171	0.046354	0.370437	0.7170
D(OVH)	-0.064424	0.045601	-1.412765	0.1812

R-squared	0.720533	Mean dependent var	1.292639
Adjusted R-squared	0.570051	S.D. dependent var	0.342485
S.E. of regression	0.224569	Akaike info criterion	0.133067
Sum squared resid	0.655608	Schwarz criterion	0.530981
Log likelihood	6.602794	Hannan-Quinn criter.	0.219425
F-statistic	4.788164	Durbin-Watson stat	1.791592
Prob(F-statistic)	0.007372		

Table 6(b)
Estimation Results of the Determinants of Profitability (Registered Finance Companies)

Dependent Variable: ROA_RFC
Method: Least Squares
Sample (adjusted): 2005Q3 2011Q2
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.958917	0.966293	-0.992366	0.3349
REG_CAP_RFC(-1)	0.141680	0.071423	1.983680	0.0637
D(NPL_L_RFC(-1))	-0.087246	0.206193	-0.423129	0.6775
CYCLE(-1)	-2.682061	3.516964	-0.762607	0.4561
D(INF(-1))	0.435251	0.159722	2.725045	0.0144
D(REER(-1))	-0.028568	0.049320	-0.579248	0.5700
D(RIR(-1))	0.387936	0.156777	2.474442	0.0242

R-squared	0.555263	Mean dependent var		0.877906
Adjusted R-squared	0.398297	S.D. dependent var		1.177179
S.E. of regression	0.913132	Akaike info criterion		2.894621
Sum squared resid	14.17478	Schwarz criterion		3.238220
Log likelihood	-27.73545	Hannan-Quinn criter.		2.985778
F-statistic	3.537471	Durbin-Watson stat		1.365776
Prob(F-statistic)	0.018543			

As shown in the above table, coefficient on the ratio of equity capital to total assets is positive and statistically significant, implying that higher capital leads to higher profitability owing to lower funding costs. Also, higher NPLs lead to lower profitability, as measured by negative and significant coefficient. Further, the coefficient on the business cycle is positive (albeit insignificant), implying good economic times are associated with increased profitability. There is only weak evidence that the banking system benefits from higher inflation and interest rate, because the estimated coefficients are smaller and statistically insignificant. Generally, inflation is associated with higher interest margins and profitability, while, the effects of interest rate depends on the speed and extent of the pass through to deposit and lending rates. Meanwhile, the coefficient on real exchange rate is positive and significant, implying that, profitability in the banking system improves with real appreciation. Finally, as expected, the coefficient of the proxy of overhead cost is negative, implying that higher overhead costs are associated with lower profitability in the banking system.

5.   Strengthening FSIs

The Central Bank of Sri Lanka is in the process of developing a financial stress index. The preliminary work has already been complete. This paper takes the preliminary work a step further by applying an alternative methodology as described below. It is well known that there is no generally accepted definition for financial stress. However, everybody recognises it, particularly when a shock occurs in the financial system and impacts the real economy. Several authors attempt to provide some guidance on how to monitor and measure the level of stress prevalent at a given point in time. For example, Hakkio and Keeten (2009) define financial stress when at least one of the following five characteristics exist in a given period: (a) uncertainty over the fundamental value of financial assets, (b) uncertainty over the investor behaviour, (c) information asymmetries, (d) substantially increased demand for assets with very low risk (flight-to-quality), and (e) substantially increased demand for assets with very good liquidity (flight-to-liquidity).

This section describes an index of financial stress –Sri Lanka's Financial Stress Index (SLFSI). There are several methods to construct a financial stress index, in terms of which indicators are to be used and how each indicator is weighed in the composite index etc. We follow the approach which is becoming popular in the literature, namely the Principal Components Analysis (PCA), which is employed elsewhere, for example, the St. Louis Federal Reserve's Financial Stress Index and the Kansas City Federal Reserve's Financial Stress Index, among others. The PCA is a statistical method of extracting factors responsible

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for the co-movement of a group of variables, where the first component is considered to be representing the market's systemic component (Campbell et al., 1997). By assuming that financial stress is mainly responsible for co-movement of the indicators, the extracted factor (the first principal component) may provide a useful economic interpretation. In particular, we use the coefficients estimates obtained from the PCA to weigh each indicator of the index. For robustness of the choice of weights used based on the PCA, we use a more traditional approach in the literature, that is to apply equal weights to each indicator. A drawback of applying equal weighting, however, is that, it assumes all sub-markets of the economy to be of equally great significance, so that, it runs the risk of overweighting/underweighting an individual indicator.

In what follows, we describe the indicators used in the SLFSI, construction of the index, and how the components of SLFSI capture financial stress during the period 2005 to 2011. A key consideration in constructing the stress index is deciding which stress indicators are to be included. We choose a total of eight components representing the key market segments in the economy, i.e., money and bond market, foreign exchange market, and equity market, while a banking sector indicator is also used, as shown below.

Table 7
Financial Stress Indicators

Variable	Risk Factor
Money and Bond Market	
Volatility of Interbank Call Money Market Rate	Affects the liquidity risk of banks
Volatility of 91-day Treasury Bill Yields	Affects the interest rate risks of banks and financial institutions
Term Spread Between 91-day Treasury Bill and 5-year Treasury Bond Yields	An indicator of the maturity risk
Foreign Exchange Market	
Volatility of the Exchange Rate (Sri Lanka Rupee to US Dollar)	An indicator of exchange rate risk
Exchange Market Pressure (EMP) Index	An indicator measuring the pressure on the currency
Equity Market	
Volatility of the All Share Price Index (ASPI)	An indicator of financial market risk and uncertainty
Beta Index of Banks, Finance and Insurance Sector	A relative measure of the Bank, Finance and Insurance Sector prices to the overall market
Banking sector	
Gross non-performing loans (NPL) ratio of banks	An indicator of credit risk of banks

Another key consideration in constructing the stress index is how to make the above indicators comparable. A common method used in this context is to normalise the indicators, i.e., each series is de-meaned by subtracting the sample average; and then dividing by the respective sample standard deviations, thereby expressing each indicator in the same units. The normalised series are used in the PCA to calculate the coefficients of each indicator in the stress index, and each normalised indicator is multiplied by the estimated coefficient and weighed together into an index. Finally, the constructed index is also normalised, so that, it has a simple and straightforward interpretation, i.e., when the level of the index is equal to zero, the index is equal to its historical mean, as such, the level of financial stress may be regarded as low. Yet, there exists the possibility that individual markets may experience higher level of stress, thus, warranting a careful examination of the level of the different components in the index, in order to obtain a detailed picture.

5.1 Data for Constructing the Financial Stress Index

The stress index is constructed on monthly observations from January 2005 to November 2011. All data is obtained from the database at the Central Bank of Sri Lanka. Unless otherwise mentioned, we use monthly average data.

5.1.1 Volatility of Interbank Call Money Market Rate

The volatility of interbank call money market rate is obtained by specifying a GARCH (1,1) model.[3] The Interbank Call Money Market Rate and its estimated volatility are plotted in the Figure 3. A higher volatility implies an increase in stress levels, which is clearly visible during 2007-2008 period with the turmoil in the financial market.

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3.   Generalized Autoregressive Conditional Heteroskedasticity Model (see Enders, 2003).

Figure 3
Interbank Call Money Market Rate and its Estimated Volatility

AWCMR
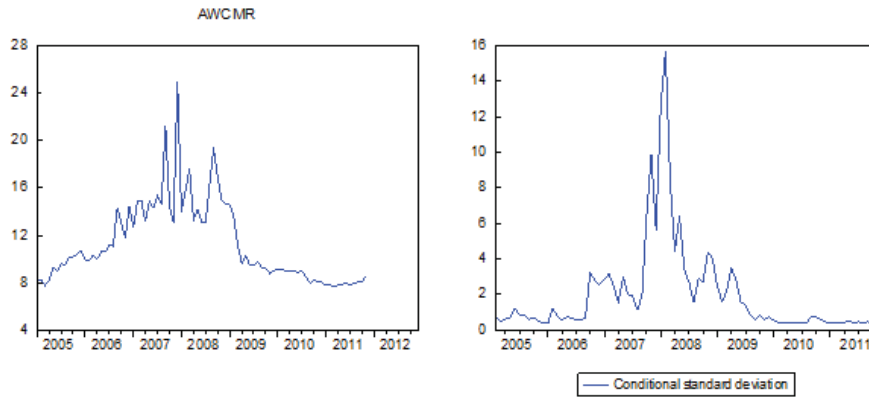
5.1.2 *Volatility of 91-day Treasury Bill Yields*

The volatility of 91-day treasury bill yields is obtained by specifying a GARCH (1,1) model, and the results thus obtained are plotted in Figure 4 with the actual series. A higher volatility implies an increase in stress levels, which is clearly visible during 2007-2009 period.

Figure 4
The 91-day Treasury Bill Yields and Estimated Volatility

TB_91

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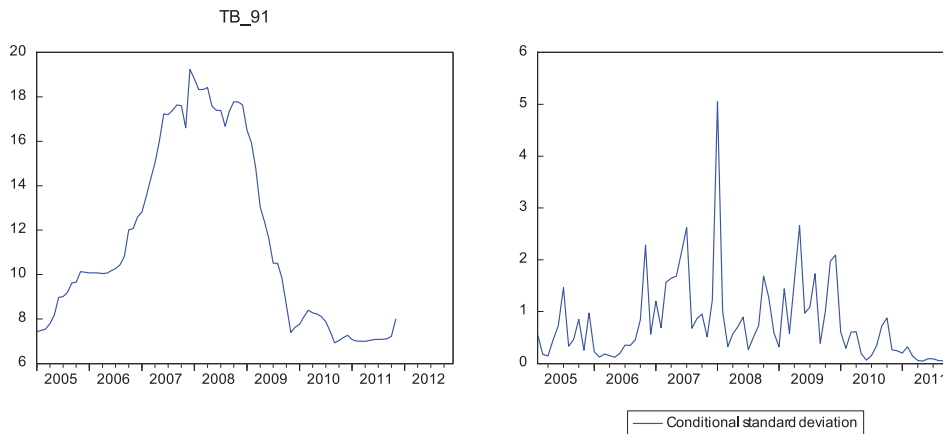
5.1.3 Term Spread

Interest rate differential for the bond market is another useful measure to represent the degree of financial stress. A higher interest rate in the bond market makes it more expensive and harder to obtain funding for banks and companies who borrow for longer periods than one year. The term spread is calculated taking the difference between 91-day Treasury Bill and 5-year Treasury Bond Yields. A higher term spread implies increased stress levels, as depicted in Figure 5.

Figure 5
Term Spread between 91-day Treasury Bill and
5-year Treasury Bond Yields

TERM_SPREAD
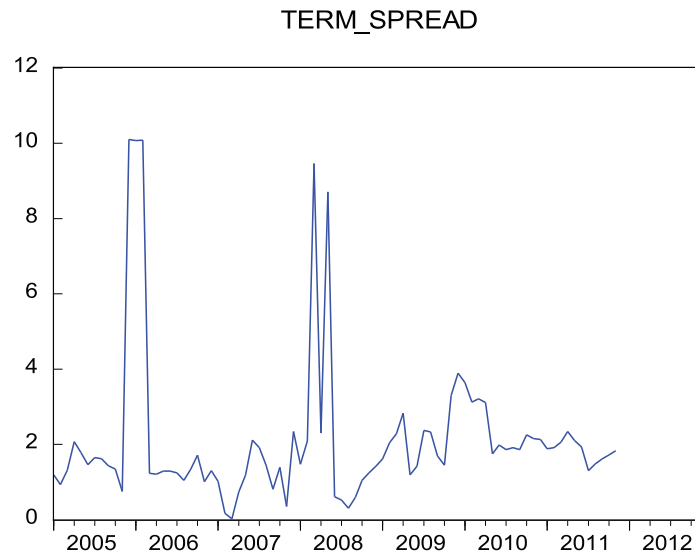
5.1.4 Volatility of the Exchange Rate

With the relaxation of foreign exchange regulations in Sri Lanka, many banks and companies opt to obtain funding in foreign currency, thus carrying a foreign exchange risk. Of course, they could manage risk with some derivative instruments. Yet, uncertainty over future exchange rates may result in increasing forward premia, and so the price of such derivatives. We measure the foreign exchange risk by estimating implied volatility in a GARCH (1,1) model of Sri Lanka Rupee against the US Dollar. Figure 6 depicts the results.

Figure 6
Exchange Rate (Rupee/Dollar) and Estimated Volatility
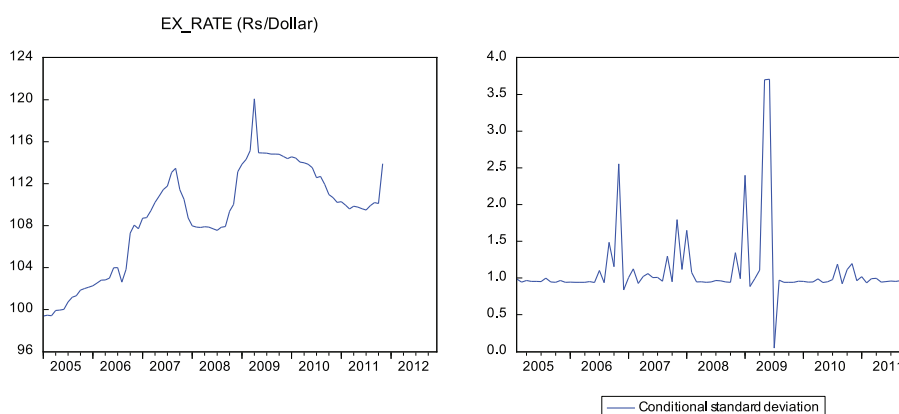
5.1.5 Exchange Market Pressure (EMP) Index

We follow Kaminsky et al., (1998, 1999) and define the exchange market pressure index as follows:

$$EMPI_t = \left(\frac{\Delta e_t}{e_t}\right) - \left(\frac{\sigma_e}{\sigma_r}\right)\left(\frac{\Delta r_t}{r_t}\right) + \left(\frac{\sigma_e}{\sigma_i}\right)\Delta i_t$$

where $EMPI_t$ is the exchange rate market pressure index in period t; e_t is the Sri Lanka rupees per US dollar in period t; r_t represents international reserves in period t; σ_e is the standard deviation of the rate of change in the exchange rate $\frac{\Delta e_t}{e_t}$; σ_r is the standard deviation of the rate of change in reserves $\frac{\Delta r_t}{r_t}$; σ_i

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is the standard deviation of the change in the nominal exchange rate Δi_t. For international reserves, we use gross official reserves[4], and nominal interest rate is proxied by weighted average call money market rate (AWCMR). All three series are obtained at the end of each month. The series thus obtained is depicted in Figure 7, where an increase in the index implies an increased stress level, as clearly observed during 2007 and 2008.

Figure 7
Exchange Market Pressure Index

EMP
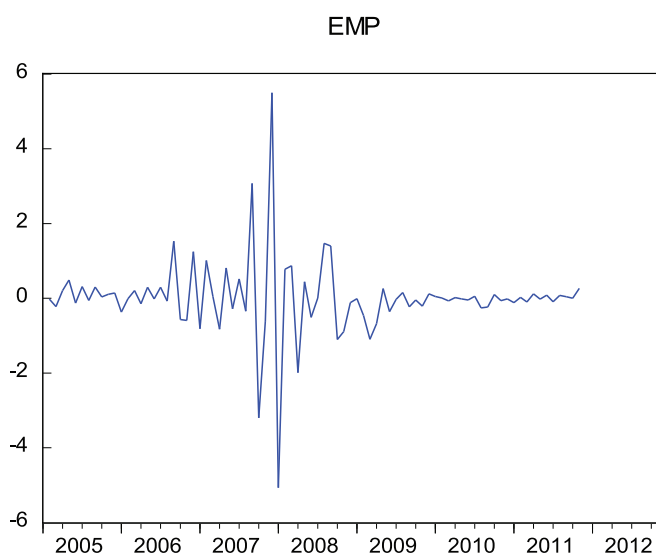
Source: Author's Estimates.

5.1.6 Volatility of the Equity Market

Sri Lanka's equity market has gained a lot of attention in the post-conflict era, with the Colombo Stock Exchange (CSE) being one of the best performing equity markets of the world in 2010. As such, the CSE has become an important source of funding for many companies, although its representation on the overall economic performance ought to be enhanced substantially. Given a variety of ways to measure financial stress in the equity market, a more common measure is the volatility of the share price index. As the Capital Asset Pricing Model implies, cost of capital is positively related to volatility, so that high volatility

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4.   Gross official reserves are calculated excluding the Asian Clearing Union (ACU) balances.

makes it more expensive for companies to obtain funding from the equity market. Also, an increase in share price is not reflected in the companies' ability to enhance profit, the increased volatility may imply a higher degree of financial stress.

We measure volatility of the equity market from an estimated GARCH (1,1) model using the All Share Price Index (ASPI) data. Figure 8 depicts the results.

Figure 8
All Share Price Index (ASPI) and its Volatility
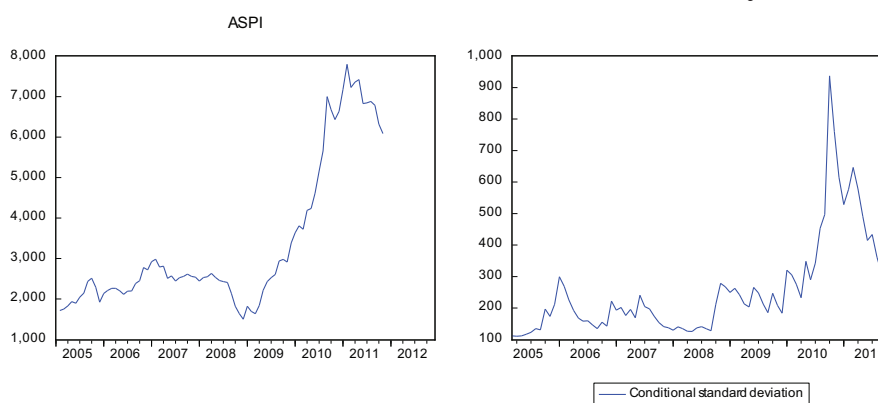
5.1.7 Beta Index of Banks, Finance and Insurance Sector

This index captures the effect of shocks in the sector compared to the overall market. The beta index is constructed as follows.

Figure 9
Beta Index of Banks, Finance and Insurance Sector

BETA
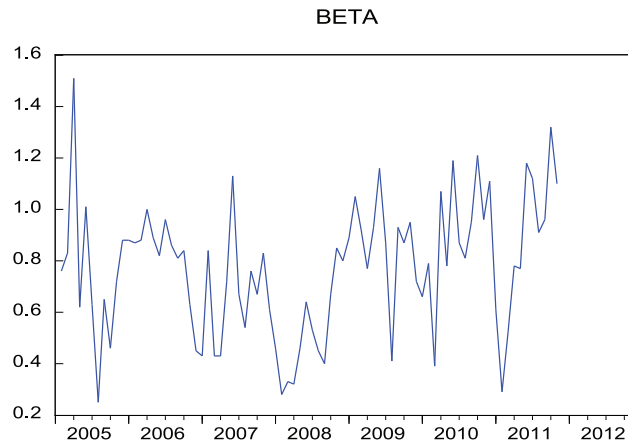
5.1.8 Gross Non-performing Loans (NPL) Ratio of Banks

Figure 10
Gross Non-performing Loans (NPL) Ratio of Banks

NPL

Source: Author's Estimates.

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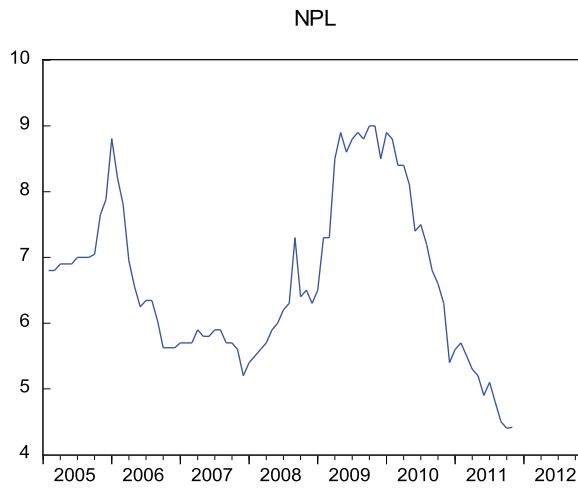
5.1.9 Normalisation of the Stress Indicators

All the stress indicators described above are normalised using the sample average and standard deviation, so that, they are expressed in same units and could be put together to form the composite index. The normalisation is carried out as follows:

$$x_i^{norm} = \frac{x_i - \bar{x}}{sd}$$

where x_i indicates the stress indicator value and $\bar{x}$ indicates the sample average, and sd is standard deviation. So, the stress index is based on deviations of each variable from its sample mean. Given our data sample covering six years (2005-2011), during which Sri Lankan economy experienced both upswings and downswings, the sample mean seems to be reasonably representative. In fact, our choice of the beginning of the data sample is mainly down to data availability. However, we believe that any truncation of available data may not be warranted as the chosen period can be regarded as fairly representative in terms of both the historical mean value and standard deviations.

The normalised series, thus obtained, are depicted in the Figure 11.

Figure 11
Normalised Stress Indicators
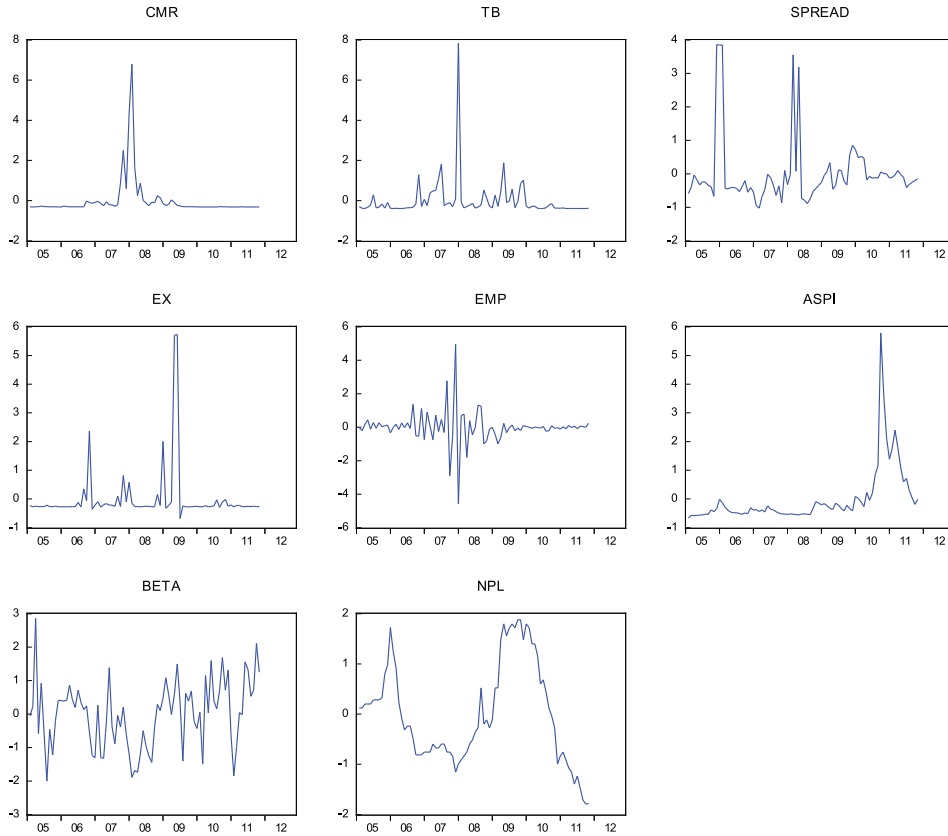
5.1.9.1   Weighting of the Indicators

In order to construct the composite index, weights are applied as follows:

$$SLFSI = w_a \times awcmr_a^{norm} + w_b \times tb91_b^{norm} + w_c \times spread_c^{norm} + w_d \times ex\_rate_d^{norm} + w_e$$
$$\times emp\_index_e^{norm} + w_f \times aspi_f^{norm} + w_g \times beta_g^{norm} + w_h \times npl_h^{norm}$$

The weights structure is determined by the estimates of PCA as shown in the Table 8. The weights in the PCA are obtained, such that, the total of the squared coefficients for each stress indicator totals one (1) (see Sandhal et al., 2011). However, a caveat is in order. The first principal component represents

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only a quarter of the total variation in the indicators used, as shown in the cumulative proportion in Table 1. Such a low explanatory power of the first component is indicative of non-existent of a common pattern among the indicators during the sample period used. If there is a significant common pattern among the indicators, the first component may capture most of its variation. For example, Sandhal et al. (2011) find that the first component for Swedish data during January 1997 to June 2011 captures about 63 percent of total variation in the Swedish indicators used. Meanwhile, in the St. Louis Federal Reserve's Financial Stress Index, the first component captures only 44 percent of the total variations of the indicators during December 1993 and December 2009. However, as the degree of variation explained by the first component becomes lower, the predictive power of the stress index becomes weaker. For robustness checks, we employ equal weights to the stress indicators used, and the results are somewhat different. This points towards high sensitivity of the stress index to methodological differences, thus, making the business of measuring the stress level in the financial marker even harder, warranting extra caution when interpreting results.

Table 8
Results of the Principal Components Analysis

Principal Components Analysis
Sample (adjusted): 2005M02 2011M11
Included observations: 82 after adjustments
Balanced sample (listwise missing value deletion)
Computed using: Ordinary correlations
Extracting 1 of 8 possible components
Maximum number of components: 1

Eigenvalues: (Sum = 8, Average = 1)

Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	1.927618	0.545244	0.2410	1.927618	0.2410

Eigenvectors (loadings):

Variable	PC 1
AWCMR	0.539180
TB91	0.584923
SPREAD	-0.076077
EX_Rate	0.155837
EMP	-0.403160
ASPI	-0.239701
BETA	-0.323650
NPL	-0.111051

Principal Components Analysis
Sample (adjusted): 2005M02 2011M11
Included observations: 82 after adjustments
Balanced sample (listwise missing value deletion)
Computed using: Ordinary correlations
Extracting 2 of 8 possible components
Maximum number of components: 2

Eigenvalues: (Sum = 8, Average = 1)

Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	1.927618	0.545244	0.2410	1.927618	0.2410
2	1.382374	0.105569	0.1728	3.309992	0.4137

Eigenvectors (loadings):

Variable	PC 1	PC 2
AWCMR	0.539180	-0.214960
TB91	0.584923	0.211597
SPREAD	-0.076077	0.165025
EX_Rate	0.155837	0.521876
EMP	-0.403160	-0.278495
ASPI	-0.239701	-0.036701
BETA	-0.323650	0.402619
NPL	-0.111051	0.606979

5.1.10 Sri Lanka's Financial Stress Index (SLFSI)

Once the weighted sum of the financial stress index is computed, it needs to be normalised, so that, the level of the index can be interpreted as the number of standard deviations from the mean value. The financial stress index, thus obtained, is depicted in Figure 9, in that, the vertical axis shows the standard deviation from the sample mean for the index. If the computed stress index is assumed to be normally distributed, one standard deviation can cover around 68 percent of the outcomes, while two standard deviations can cover around 95 percent, and three standard deviations can cover 99.6 percent. As shown in the Figure 7, SLFSI exceeds three standard deviations once (i.e., January 2008), and within the limit of two standard deviations in all other times (based on the PCA method), while, based on the equal weight method, the index exceeds three standard deviations once (i.e., May 2009), and remains within two standard deviations band, except once in (i.e., October 2010). As shown in the bottom panel of Figure 12, the two indexes computed from both methods follow one another closely over time, so that, the qualitative information contained in the indexes is very much the same. Yet, in four occasions some tangible differences arise between the two indexes.

By examining the individual stress indicators and the composite stress index, some reference can be made as to which stress indicator(s) may be mainly responsible for major movements in the stress index. First, the slight increase the index observed right at the beginning of the sample seems to have been caused by an increased beta index. Second, the increase in third quarter of 2005 (i.e., August 2005) is driven mainly due to the increase in the term spread. Third, the rest of the major hikes observed since 2005 through mid 2009 are mainly driven by the volatility in the 91-day TB yields, while the dips in couple of occasions during 2007/08 are mainly due to EMP index movements. Fourth, the key feature that stands out in the plot is the big hike in early 2008 (particularly in January 2008) which is due to a combined effect of volatility of call money market rates, the 91-day TB yields and EMP index movements. Finally, of the movements towards the end of the sample, the hike observed around third quarter of 2010 (i.e., October 2010) is mainly caused by the volatility in ASPI, while the mild increase right at the end of the sample is mainly attributed to beta index movements.

Figure 12
Sri Lanka's Financial Stress Index

SLFSI_PCA Method

FSI_Equal Weight Method

FSI_PCA_Method
FSI_Equal_Weight_Method
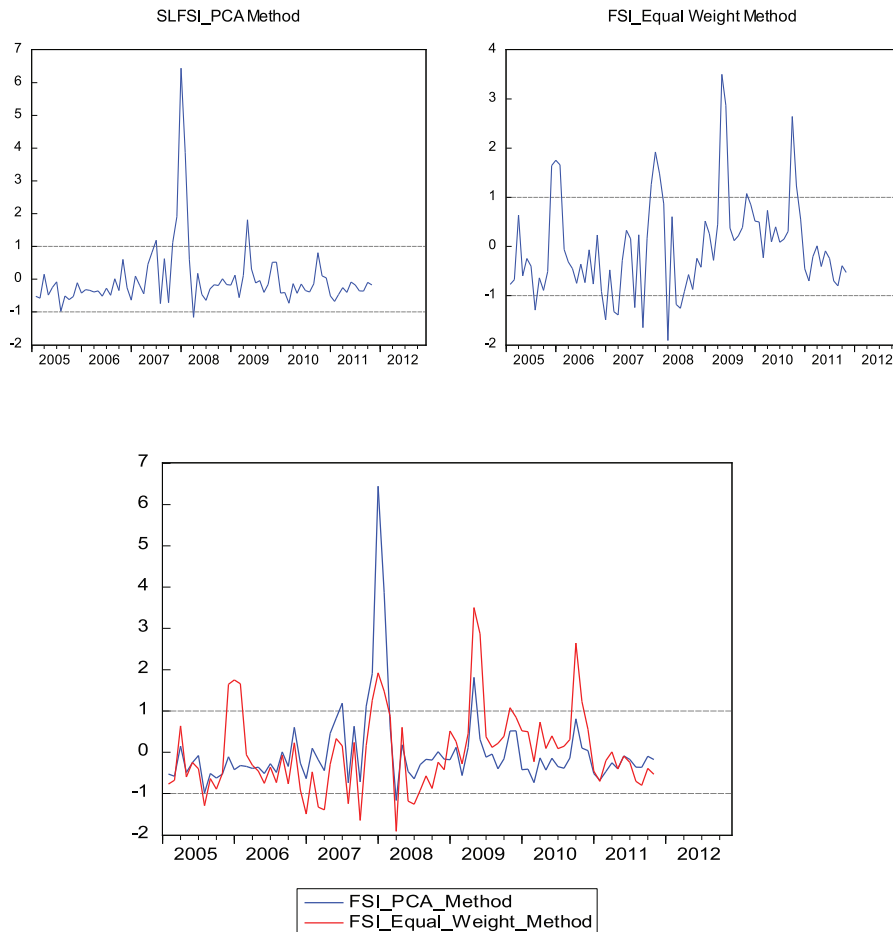
6. Policy Recommendations

The potential risk to financial system stability in Sri Lanka could emanate from the several sources. The financial system in Sri Lanka is broadening with growing interlinkages between markets and institutions. The continued relaxations of exchange control regulations would widen the interlinkages across international borders. Recently, there has been some volatility in capital flows to and from Sri Lanka. In a major part of 2011, expanding trade deficit due to larger import expenditure exerted immense pressure on the exchange rate, thus, making expectations of currency movements somewhat unstable. Curtailing import

expenditure while strengthening the capital and financial account became a key priority area. In that context, an improved management of systemic liquidity needed to be well maintained by limiting foreign exchange intervention and allowing exchange rate movements. Accordingly, the Government of Sri Lanka and the Central Bank have initiated significant policy measures in early 2012. Such key measures were targeted at limited intervention in the domestic foreign exchange market, while allowing exchange rate to be determined largely by the market forces, and curtailing the private sector credit growth. Because strong incentives for capital inflows may impede systemic liquidity management and control, further efforts to drain large amounts of liquidity as deem to be necessary would greatly help reduce financial stability risks.

Banking sector credit which recorded 31 percent during 2011 moderated in recent months due to the imposition of credit limits to the commercial banks by the Central Bank. Therefore, a main near-term source of risk would be the impact of the recent sharp credit expansion on banks' asset quality. This is particularly important for Sri Lanka, as about 50 percent of its banking industry's asset base is owned by state banks. For example, by end 2011, two state LCBs accounted for about 35 percent of market share, while three state LSBs accounted for about 14 percent of the assets in the banking industry. While some considerable progress has been made in addressing structural weaknesses and liquidity management problems that the state owned banks experienced in the past, policy attention may need to be continuously focused on maintaining required capital adequacy at all times. Further, a greater use of market-oriented monetary policy instruments to stem credit expansion is encouraged, rather than administrative limits on bank lending. The use of interest rates would enhance the efficiency of capital allocation, while strengthening the role of monetary policy and reducing financial stability risks associated with off-balance sheet lending.

Further the rise of off-balance sheet exposures may warrant significant policy attention over the near-term. For instance, the off-balance sheet exposure of the banking industry rose significantly during first nine months of 2011, recording a 36 percent increase over the last year. Further, the off-balance sheet exposure as a percentage of the total on-balance sheet assets increased to 57 percent during first nine months of 2011, compared to 50 percent during the same period in 2010. Particularly, the foreign exchange sales and purchases contributed to 39 percent of this increase in off-balance sheet exposure. This is even more important in the context of recent volatility in the exchange rates, which would expose the banks to market risk due to the open positions in both on-balance sheet and off-balance sheet assets and liabilities. The exposure of

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the banking industry to such exchange rate risks could be further limited by restrictions on the net open position of individual banks, based on the bank's capital base. Further, the prudential directions on foreign exchange risk management and derivative products would minimise the banks' adverse foreign currency exposures.

The registered finance company (RFC) sector needs to adopt best practices in corporate governance and risk management frameworks as RFCs expand and grow in size. It is envisaged that most of the companies are still entrenched with traditional practices which hinders the industry repositioning to a sustainable growth phase. About fifteen companies in this industry are required to find new capital in order to meet the revised minimum core capital requirement to meet the expected increased business demand and be able to be better equipped to absorb risk, with expanding economic activity in the country. The overall RFC industry has an exposure of 27 percent of capital funds to equity investment as at September 2011, whereas according to the RFC directions the threshold is 25 percent of capital funds. Meanwhile, the specialised leasing company (SLC) sector has concentrated more on borrowings, rather than maintaining a healthy level of capital funds. Borrowings represent 70 percent of total liabilities while capital funds represent only 18 percent of total liabilities. Against this backdrop, the new legislation which was enacted in 2011, namely, The Finance Business Act, No.42 of 2011, is a welcome move, with more investigative powers, a broadened definition for finance business and enhanced penalties for offences. Yet, more efforts may be needed to formulate a framework to resolve weak financial institutions on a timely basis, thus, facilitating orderly resolution and winding up, if needed, of distressed financial institutions. Also, establishing a separate regulatory and supervisory mechanism to regularise business activities of microfinance institutions may need to be given policy priority.

The insurance sector in Sri Lanka has a great potential, yet there are some structural deficiencies in the sector. The insurance sector still accounts for about 1.5 percent of GDP in Sri Lanka, which is significantly lower compared to other comparable countries. The insurance sector is highly concentrated, with 2 companies accounting for 62 percent of total assets, while 5 companies accounting for 90 percent of total assets, out of the existing 19 companies. Further, the state-owned composite insurance company accounts for about 40 percent of total assets and 42 percent of composite insurance assets. The life insurance sub-sector is dominated by 3 insurers accounting for 83 percent of total assets and the 2 largest general insurers account for 57 percent of the assets of this sub-sector. There have been a number of positive developments in the insurance sector in order to improve insurance supervision such as increasing powers of

the Insurance Board of Sri Lanka (IBSL) to issue directions to insurance companies, brokers and loss adjusters. However, the high concentration in the insurance sector is matter of concern, particularly, in the low interest rate environment and moderation in the growth in equity prices.

In addition to sector specific policy measures, a broad policy changes will also be needed to ensure financial stability over the medium- to long-term, while supporting continued strong and balanced economic growth. Sri Lanka would need to configure its financial policies in order to foster domestic savings, thus reducing the saving-investment gap. It is envisaged that the economy may need to broaden its financial markets and services, offering the enterprises more avenues for financing. At the time, households may need to be equipped with robust financial literacy by expanding financial literacy programmes, and the upgrade of financial infrastructure and legal framework. More importantly, the households may be provided with a broader range of financing and investment possibilities by the introduction of new products with increased access and stronger consumer protection, rather than confining to traditional financial methods. Also, the government's role and responsibilities may be reoriented towards more a market based system. Particularly, the state banks' large exposures to some underperforming key state-owned enterprises need to be reduced, while allowing these banks to have the tools and incentives to make lending decisions based on commercial goals.

7. Conclusion

The objective of this paper is to assess the financial stability indicators in Sri Lanka in the context of their interlinkages to macroeconomic variables, given the steadily developing financial sector in Sri Lanka. During the last several years, Sri Lanka has initiated important legislative and regulatory reforms in order to strengthen the banking and non-banking supervision, while improving the financial market infrastructure. As a result, the financial system has been remarkably stable and resilient, despite a challenging macroeconomic environment, in the face of a widening current account deficit and accelerating domestic credit growth. As such, the performance in the banking system has improved on the back of robust economic growth which marked about 8 percent on average during the last couple of years.

In order to examine statistical relationships among the FSIs and macroeconomic variables, the paper used some econometric models. The paper examined the relationship between FSIs and the business cycle using simple correlation relationships, as well as econometric methodology where FSIs are

modeled as a function of macroeconomic and structural variables. The findings evidenced that FSIs vary substantially with the fluctuations in the business cycle, thus, pointing towards the necessity of considering the phase of the business cycle in the analysis of FSIs. However, results implied some heterogeneity among the relationships between FSIs and business cycle across different sectors in the financial system. Hence, sector specific factors may need to be closely monitored. Meanwhile, econometric tests delivered some useful results: (a) estimates showed dynamic short-run relationships between capital ratio and the explanatory variables. The coefficient on lagged capital ratio is negative and statistically significant, implying that any deviation of the capital ratio from the target level does not get corrected instantaneously; (b) there is a negative correlation between asset quality and business cycle, implying that during economic booms, asset quality improves. Also, there is strong evidence that interest rates worsen the asset quality; (c) the coefficient on the ratio of equity capital to total assets is positive and statistically significant, implying that higher capital leads to higher profitability and so on. Also, results suggest that higher NPLs lead to lower profitability and higher economic growth lead to higher profitability.

Further, the paper constructed a composite Financial Stress Index for Sri Lanka, using seven individual stress indicators representing the money and bond market, foreign exchange market, equity market and the banking sector. By examining the individual stress indicators and the composite stress index, useful reference could be made as to which stress indicator(s) may be mainly responsible for changes in the level of stress in the financial market.

Overall, the banking system is expected to be stable, while some challenges may arise. Particularly, in view of the high credit growth, banks need to guard against credit risk by maintaining prudent underwriting standards and provisioning levels. The banking sector also needs to continue to pay attention to maturity mismatches to address liquidity concerns. Capital funds of the banking sector increased on account of retained earnings and fresh capital infusions to meet enhanced capital requirements. Nonetheless, greater challenges to financial sector efficiency may arise due to the presence of large public sector involvement. The increasing exposure of banks to advanced banking products with the rapid financial innovations which require high dependence on information technology and wide use of advanced technologies for transaction processing may increase the operational risk of the banks over the short- to medium-term.

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Aggregated Microprudential Indicators (Financial Soundness Indicators)

Core Set	
Deposit-Taking Institutions	
Capital adequacy	Regulatory capital to risk-weighted assets
	Regulatory tier I capital to risk-weighted assets
Asset quality	Nonperforming loans to total gross loans
	Nonperforming loans net of provisions to capital
	Sectoral distribution of loans to total loans
	Large exposures to capital
Earnings and profitability	Return on assets
	Return on equity
	Interest margin to gross income
	Noninterest expenses to gross income
Liquidity	Liquid assets to total assets (liquid asset ratio)
	Liquid assets to short-term liabilities
Sensitivity to market risk	Duration of assets
	Duration of liabilities
	Net open position in foreign exchange to capital
Encouraged Set	
Deposit-taking institutions	Capital to assets
	Geographical distribution of loans to total loans
	Gross asset position in financial derivatives to capital
	Gross liability position in financial derivatives to capital
	Trading income to total income
	Personnel expenses to noninterest expenses
	Spread between reference lending and deposit rates
	Spread between highest and lowest interbank rate
	Customer deposits to total (noninterbank) loans
	Foreign currency-denominated loans to total loans
	Foreign currency-denominated liabilities to total liabilities
	Net open position in equities to capital

Market liquidity	Average bid-ask spread in the securities market Average daily turnover ratio in the securities market
Nonbank financial institutions	Assets to total financial system assets Assets to GDP
Corporate sector	Total debt to equity Return on equity Earnings to interest and principal expenses Corporate net foreign exchange exposure to equity Number of applications for protection from creditors
Households	Household debt to GDP Household debt service and principal payments to income
Real estate markets	Real estate prices Residential real estate loans to total loans Commercial real estate loans to total loans

Financial Soundness Indicators - All Banks

		2006	2007	2008	2009	2010	2011
1	**Capital Adequacy**						
1.1	Regulatory Capital to Risk Weighted Assets(RWCAR)	13.3	14.1	14.5	16.1	16.2	16.0
1.2	Tier 1 Capital/Risk Weighted Assets(Tier 1 RWCAR)	12.1	12.6	12.5	14.1	14.3	14.3
1.3	Net Non - Performing Loans to Total Capital Funds	14.8	14.1	18.5	26.2	15.2	11.5
1.4	Debt to Capital Funds	238.5	220.0	209.4	160.1	172.0	171.4
1.5	Capital to Assets Ratio	7.6	8.0	8.1	8.1	8.3	8.7
2	**Asset Quality**						
2.1	Gross Non - Performing Loans (NPL) to Total Gross Loans (w/o Interest in Suspense)	5.6	5.2	6.3	8.5	5.4	3.8
2.2	Gross Non - Performing Loans (NPL) to Total Gross Loans (with Interest in Suspense)	7.4	6.8	8.1	10.7	7.3	6.2
2.3	Net Non-Performing Loans to Total Gross Loans	2.3	2.4	3.4	5.0	3.0	2.1
2.4	Prov Made against Gross Loans	3.8	3.3	3.8	4.5	3.1	2.2
2.6	Provision Coverage Ratio (Total)	66.9	64.5	60.9	53.0	58.1	57.1
2.5	Provision Coverage Ratio (Specific)	61.2	55.3	47.6	42.8	45.3	46.0
2.6	Sector-wise NPL to Total Sector Loans						
	Agriculture & Fishing	5.7	6.4	7.1	4.2	3.2	2.5
	Manufacturing	7.9	8.3	8.3	11.4	8.7	6.4
	Tourism	6.1	4.4	3.7	5.3	4.7	11.4
	Transport	5.3	6.5	7.4	6.7	4.2	2.8
	Construction	6.3	5.6	8.6	12.5	8.4	7.5
	Traders	11.3	8.0	10.1	10.9	7.5	5.3
	New Economy	6.2	1.8	3.1	4.4	3.4	2.7
	Financial and Business Services	1.8	2.1	2.3	4.4	2.4	1.4
	Infrastructure	5.5	2.0	3.1	5.5	3.9	2.6
	Other Services	2.8	3.3	2.1	6.3	3.2	2.1
	Other Customer	3.1	3.3	3.3	5.5	3.3	1.7
2.8	Sectoral Distribution of Loans to Total Gross Loans						
	Agriculture & Fishing	4.5	4.9	5.2	10.7	13.4	13.1
	Manufacturing	14.8	16.1	17.3	15.1	13.0	12.0
	Tourism	2.1	2.1	2.4	2.7	2.1	2.2
	Transport	1.9	2.1	2.1	1.6	1.7	2.2
	Construction	17.0	17.9	16.8	17.2	16.5	13.9
	Traders	13.9	12.6	12.9	13.8	14.0	11.2

	New Economy	3.5	2.3	1.3	1.4	0.9	0.9
	Financial and Business Services	5.8	6.2	5.6	4.1	4.6	6.1
	Infrastructure	1.4	1.3	1.3	1.3	1.3	1.3
	Others Services	4.5	4.7	5.7	4.9	6.4	7.2
	Other Customer	30.6	29.8	29.4	27.2	26.0	30.0
2.9	Provision Made against Total Assets	2.3	2.0	2.3	2.4	1.8	1.3
2.10	Total Loans(Gross) to Total Assets	60.2	61.3	60.6	53.0	55.6	61.2
2.11	Investments to Total Assets	22.8	22.1	25.0	30.8	30.4	24.9
2.12	Total Income to Total Assets	10.6	12.7	14.8	14.1	11.3	9.8
2.13	Net Interest Income to Total Assets	4.0	4.1	4.3	4.3	4.2	3.9
2.14	Operating Income to Total Assets	5.5	5.7	6.3	6.3	6.1	5.3
3	**Earnings & Profitability**						
3.1	Return on Equity(ROE)-After Tax	15.2	14.0	13.4	11.8	22.2	19.7
3.2	Return on Assets(ROA)-Before Tax	1.9	1.9	1.9	1.8	2.7	2.4
3.3	Return on Assets(ROA)- After Tax	1.2	1.1	1.1	1.0	1.8	1.7
3.4	Interest Income to Gross Income	85.6	87.4	86.3	86.0	83.1	85.5
3.5	Net Interest Income to Gross Income	37.5	31.9	28.9	30.8	37.7	39.4
3.6	Non Interest Income to Total Income	14.4	12.6	13.7	14.0	16.9	14.5
3.7	Non Interest Expenses (Operating Expenses) to Total Income	29.6	23.7	22.3	22.8	26.6	27.9
3.8	Staff Expenses to Non Interest Expenses	43.8	44.2	44.5	46.5	45.2	43.7
3.9	Personnel Expenses to Total Income	13.0	10.5	9.9	10.6	12.0	12.2
3.10	Provisions to Total Income	3.8	3.6	4.2	6.2	0.6	1.2
3.11	Total Cost to Total Income	77.4	79.2	79.8	78.1	71.9	73.9
3.12	Efficiency Ratio	56.7	55.6	55.6	56.3	47.4	52.3
3.13	Interest Margin	4.4	4.4	4.4	4.6	4.6	4.2
4	**Liquidity**						
4.1	Liquid Assets to Total Assets	26.7	28.1	28.4	35.3	31.4	26.8
4.2	Statutory Liquid Assets Ratio- DBU	30.4	30.4	31.3	39.2	36.6	32.4
5	**Assets/Funding Structure**						
5.1	Deposits	69.8	69.5	69.6	74.1	72.8	72.3
5.2	Borrowings	18.1	17.6	17.0	12.9	14.3	14.9
5.3	Capital to External Funds	8.6	9.2	9.4	9.3	9.5	10.0
5.4	Credit to Deposits	86.3	88.1	87.0	71.5	76.4	84.7
5.5	Credit to Deposits & Borrowings	68.5	70.3	70.0	60.9	63.9	70.2
5.6	Credit to Deposits & Borrowings & Capital	63.1	64.4	64.0	55.7	58.3	63.8

Source: Central Bank of Sri Lanka.

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Annex III

FSIs for Registered Finance Companies

Figure A1: Capital-based FSIs for Registered Finance Companies
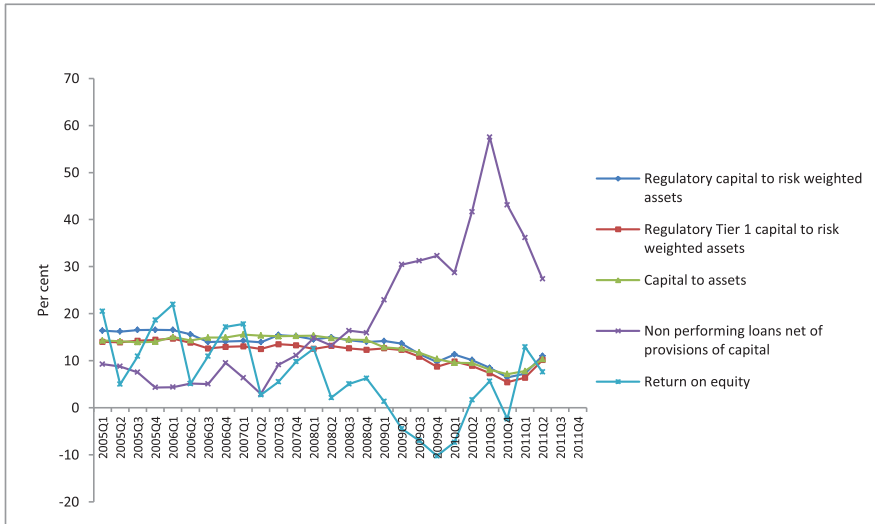
Source: Central Bank of Sri Lanka.

Figure A2: Asset-based FSIs for Registered Finance Companies
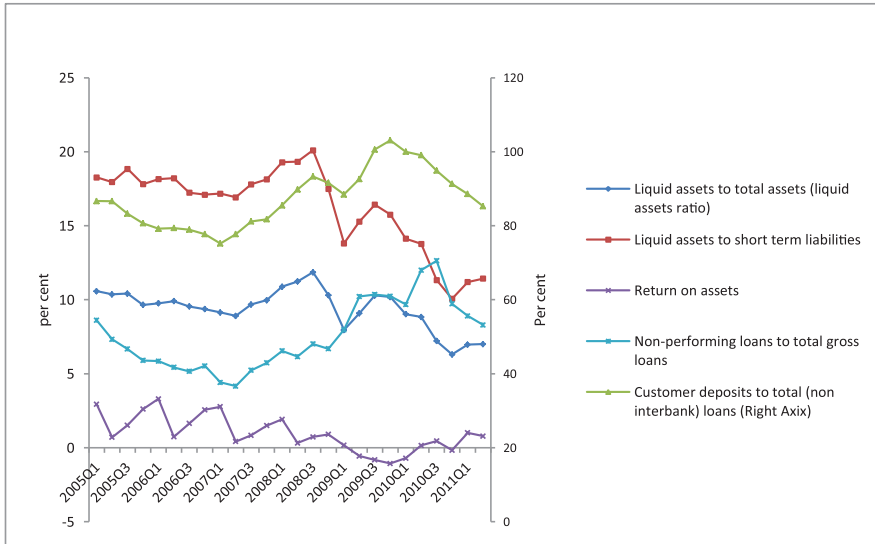
Source: Central Bank of Sri Lanka.

Figure A3: Income- and Expense-based FSIs for Registered Finance Companies

Source: Central Bank of Sri Lanka.

FSIs for Specialised Leasing Companies

Figure A4: Capital-based FSIs for Specialised Leasing Companies

Source: Central Bank of Sri Lanka.

Figure A5: Asset-based FSIs for Specialised Leasing Companies
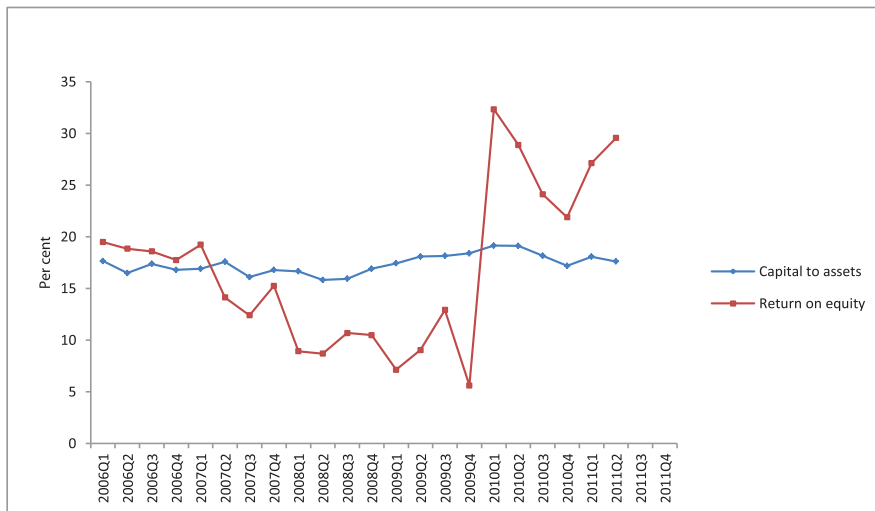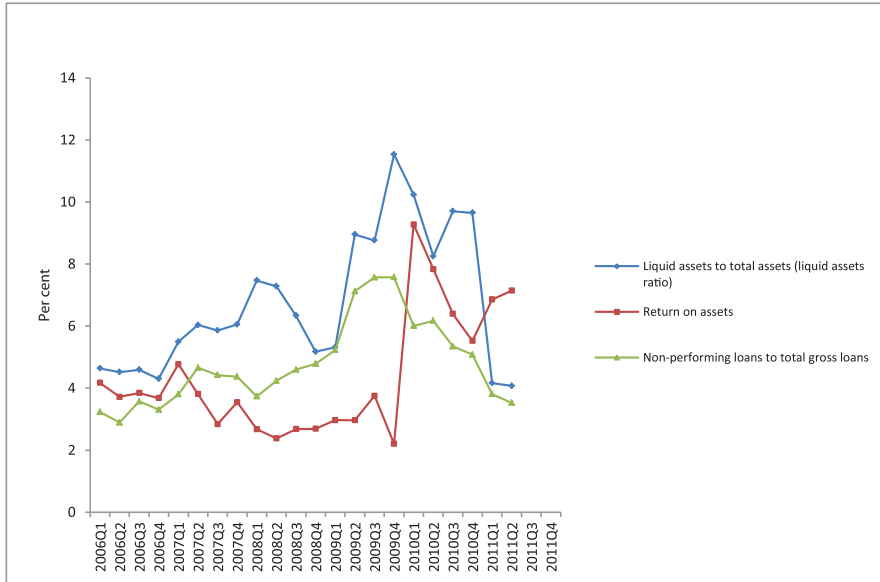

Source: Central Bank of Sri Lanka.

Figure A6: Income- and Expense-based FSIs for Specialised Leasing Companies
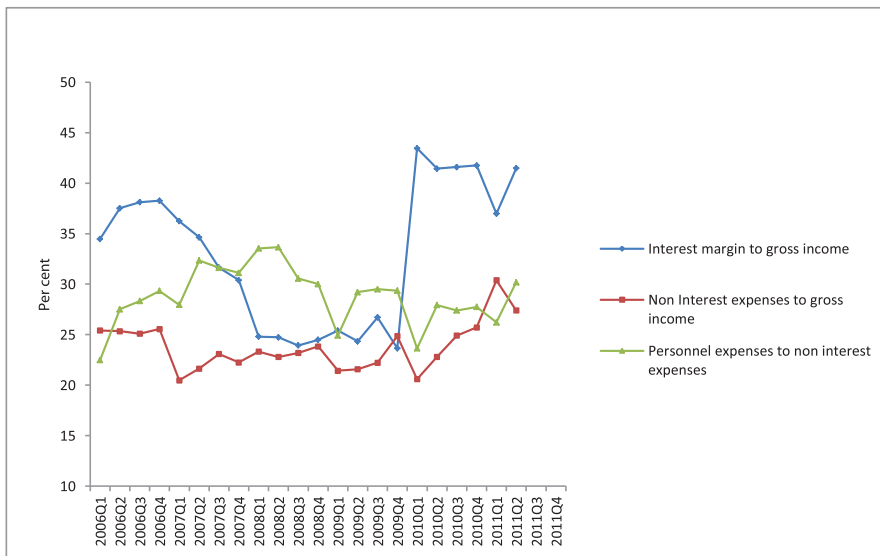
Source: Central Bank of Sri Lanka.

Chapter 7

STRENGTHENING FINANCIAL STABILITY INDICATORS IN THE MIDST OF RAPID FINANCIAL INNOVATION: UPDATES AND ASSESSMENTS FOR CHINESE TAIPEI

By
Johnny T. C. Hou[*]

The recent transatlantic financial crisis[1] and global economic fluctuations have highlighted the importance of sound risk management for financial stability and the need to address systemic risks.[2] This paper attempts to give an update and assessment on financial stability indicators in the midst of rapid financial innovations. The focus of the paper will be on macroprudential indicators with the explicit objective of promoting the stability of the financial system as a whole, not just the individual institutions within it.

The remainder is organised as follows. Section 1 is the introduction. We outline the main features of the recent financial crisis and the targeted prudential measures of the Central Bank, Chinese Taipei (CBC). Section 2 explores the reasons why we need financial stability indicators. We also describe the structure of the financial system in Chinese Taipei and the financial stability indicators in the CBC's Financial Stability Reports. Section 3 provides the literature review. In mparticular, we focus on theories of financial instability and related research analyses on indicators. Section 4 describes the analytical framework for macroprudential indicators in Chinese Taipei. Section 5 deals with empirical VAR model studies. Section 6 offers policy recommendations, in which we propose a "precautionary set" of macroeconomic and market-based indicators in the Financial Soundness Indicators. The last part, Section 7, provides conclusion.

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1. The definition of a financial crisis according to Mishikin (1991) is "A disruption to financial markets in which adverse selection and moral hazard problems become much worse, so that financial markets are unable to efficiently channel funds to those who have the most productive investment opportunities."

2. A proposed definition arising from work by the IMF, FSB and BIS for the G20 defines systemic risk as "a risk of disruption to financial services that is caused by an impairment of all or parts of the financial system and has the potential to have serious negative consequences for the real economy", quoted in CGFS (2010, p.2).

1. Introduction

1.1 Main Features of the Recent Financial Crisis

One distinguishing feature of the recent financial crisis is its opacity. "Why didn't you tell us?" asked HM the Queen of England when visiting the London School of Economics in 2008 (Spaventa, 2009). The Bank of England also admitted in its October 2008 Financial Stability Report that "while…weaknesses had been identified, few predicted that they would lead to such dislocation in the global financial system." As the crisis spread globally, the speed, force and breadth with which these risks combined were not fully anticipated. Few market participants or regulatory authorities saw it coming, and all underestimated its severity. Thus, the recent crisis has provided an opportunity for renewed interest in proposals to strengthen the financial stability indicators and improve the stability of the financial system.

Another distinguishing feature of the recent crisis relative to previous ones is speed (Trichet, 2011). While the sovereign debt crises in the 1980s unfolded over the course of years, the Asian financial crisis developed, over months rather than years. The major intensification of the recent financial crisis spread around the globe in the course of days. The room for maneuver to counter shocks has been reduced. Jean-Claude Trichet also pointed out that the understanding of the fundamental dynamics of financial systems and the risks they generate needs to be deepened, in particular in relation to financial innovation and the role of nonbank financial intermediaries.

The last distinguishing feature of the recent financial crisis is its systemic focus. While regulatory authorities and market participants may be aware of risks at an individual or micro level, they may fail to see the build-up or the effect of risk taking at a broader level across the entire financial system. The recent financial crisis has shown that relying only on aggregated micropurdential indicators is insufficient to detect and mitigate systemic risks.

1.2 Role of Central Banks in Financial Stability Policy

Which institution will provide the most reliable assessment of financial stability within an economy? Central banks do have a stake in macroprudential policy. They are seen as bearing important responsibilities for financial stability, if sometimes only implicitly so. Caruana (2010) explained that the central banks are the ultimate guarantors of financial system stability, and for several reasons. Central banks are the only institutions able to provide almost unlimited system-

wide liquidity at very short notice.[3] They play an essential role in overseeing and ensuring the resilience of the payment and settlement infrastructure that is central to the modern financial system. They also devote considerable resources to monitoring and analysing macroeconomic and financial trends.

CGFS (2010) also explained that the objectives, instruments and conduct of macroprudential policy are part of an overall economic and financial stabilisation function that includes monetary policy of central banks. Successful macroprudential policy and monetary policy could reinforce each other to stabilise the economy. Overall, central banks are naturally positioned to play a prominent role in financial stability policies, and should provide useful information to identify and monitor important financial trends and emerging risks by financial stability indicators.

It is worth mentioning that under Article 2 of the *Central Bank of the Republic of China (Taiwan) Act* promulgated in May 1935, the primary objectives, which are to guide all its policies and decisions, of the Bank's operations shall be: to promote financial stability; to guide sound banking operations; to maintain the stability of the internal and external value of the currency; and to foster economic development within the scope of the above objectives. For most Asian central banks that adopt inflation targeting to maintain price stability, the mandate of the Central Bank, Chinese Taipei (CBC) is much more broadly defined, where promoting financial stability and ensuring sound banking operations remain part of the Bank's operational objectives.[4] In today's terminology, we call this "macroprudential policy". In a narrower sense, the term "macroprudential"[5] refers to the use and calibration of prudential tools with the explicit objective of promoting the stability of the financial system as a whole, not just the individual institutions within it, as suggested by Caruana (2010).

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3. The actions can be seen as the modern-day equivalent of a 'lender-of-last-resort'.

4. The IMF (2011b) survey indicates that the central banks are given a financial stability mandate in most economies (90 percent) that responded to the survey after the recent financial crisis.

5. The term "macroprudential" was coined in 1979 in the Bank of England, very likely by David Holland. It principally related to likely unsustainable aggregate credit exposures to emerging market countries, not visible to, or not recognised by individual market participants. At that time, it seems more to have referred to an approach to information assembly and analysis, rather than an instrument of supervision, even when it was used in an expression such as "macroprudential supervision" (Green, 2011).

1.3 Prudential Measures for the Recent Financial Crisis

The recent financial crisis has sparked many proposals to address its perceived causes and prevent a recurrence. The approach already adopted in many SEACEN economies is by publishing Financial Stability Reports (FSR). These reports review the condition of the financial system, identify and assess risks to the system, and suggest market or policy changes to address significant risk concerns. They are usually prepared by the country's central bank and released on a regular basis.

There are many ways to review the current financial conditions and to identify and assess risks. One approach is to use traditional financial stability indicators, based on recently collected data. They include indicators such as return on assets (ROA), capital to risk-weighted assets ratios (CAR), and liquid assets to short-term liabilities ratios for financial institutions, household borrowing to GDP ratios, payments to disposable income ratios for households, return on equity (ROE), borrowing and total liabilities to equity for nonfinancial corporations. In addition, land price index, residential and commercial loans to total loans ratios for real estate market, and turnover ratios for stock and bond markets may also be included. These financial indicators can provide useful information about the present state of the financial system and encourage central banks to identify and monitor important financial risks.

To facilitate international comparison, the CBC also publishes the results of "Financial Soundness Indicators" in its Financial Stability Report from 2008 on. All items are compiled in accordance with the "Compilation Guide on Financial Soundness Indicators" issued by the IMF in July 2004. Each financial soundness indicator is designed to capture the sensitivity of the financial system to a specific risk factor (credit or market risk). Besides, the aims of these indicators are to offer insight into the state of Chinese Taipei's financial system and its potential vulnerabilities and risks, and to spark broad-based discussion that will enhance awareness of risk among market participants and spur them to take responsive action in a timely manner. However, the methodologies are developed in Financial Soundness Indicators only with publicly available data, and under these limitations the results are only broadly suggestive.

1.4 The CBC's Targeted Prudential Measures to Stabilise the Property Market

Since mid-2009, the strong recovery in most Asian economies has attracted massive capital inflows and caused housing prices to rise rapidly. In response,

some governments, including those of China, Hong Kong and Singapore, have taken action to prevent negative impacts from potential housing bubbles (IMF, 2011b). Meanwhile, Chinese Taipei's housing market has also continued to recover and housing prices have kept rising since the second half of 2009. From the first quarter of 2009 to year-end 2010, existing-home prices rose 32 percent. The increase in housing prices has been more pronounced in the Taipei metropolitan area, adding to the burden of homebuyers. Moreover, this area has posted higher price-to-income (PTI) ratios and loan-to-income (LTI) ratios than elsewhere in Chinese Taipei (Annual Report 2010, CBC).

According to the FSR 2011, in view of high housing prices in certain areas and excessive concentration in real estate-related loans, the CBC has gradually adopted a series of targeted prudential measures since October 2009 to further enhance financial stability, including requiring banks to enhance their risk management of real estate-related loans using moral suasion; signaling that the CBC will take asset prices into account in its monetary policy; enhancing collection and analysis of real estate-associated statistics; conducting target examination and formulating/amending regulations to land collateralised loans and housing loans; urging banks to strengthen risk management on loans to real estate investors in certain areas. The policies have delivered positive effects with the cooperation of banks through adjusting their mortgage policies regarding loan-to-value (LTV) ratios, interest rates and grace periods.

The CBC's Board has also approved an amendment to the *Regulations Governing the Extension of Housing Loans in Specific Areas by Financial Institutions*, promulgated on 25 June 2010. Major amendments are as follows: extending the scope of the Specific Areas, lowering the cap of LTV ratio on second housing loans for home purchases in Specific Areas, and collateralised land loans will be subject to a ceiling ratio of LTV, effective from 31 December 2010. The CBC's measures have been implemented actively and effectively. For instance, the ratio of housing loans to all outstanding loans fell to 27.54 percent at the end of 2010 from 27.97 percent in June 2010. The ratio of newly extended loans for housing in Specific Areas to total outstanding new housing loans also went down from 59 percent to 53 percent during the same period. Moreover, in order to help financial institutions and the public understand more details about the foregoing regulations, further explanations and Q & A were posted on the CBC's website in January 2011.

2. Financial Stability Indicators

2.1 Macroprudential Indicators

Financial stability indicators can provide useful information about the present state of the financial system, but they may be less helpful in evaluating the future conditions and risks. Since every crisis possesses its idiosyncratic characteristics, lessons learned from the past crises may not be able to protect against future crises. Cochrane (2010) addressed this concern, stating that "Keep in mind that regulators did not see any of this (i.e., crisis) coming, any more than the rest of us". Past experience is rarely a reliable guide to the future and such risks are unlikely to be predictable with any degree of precision. As Milton Friedman[6] put it, "The attempt to do more than we can, will itself be a disturbance that may increase rather than reduce instability".

Risk management is a new kind of business of finance. Many financial institutions get used to funding longer-term assets by acquiring short-term liabilities and that is vulnerable to economic shortfalls and risks. They operate to capture the potential impact of changes in volatilities and correlations on asset values as well as on solvency risks. Even though banks differ from one another in their initial capital ratios and sizes, risk profiles and loan concentrations, the financial and economic shocks can be expected to produce correlated risks for banks, some of which have similar asset and liability structures.

The global financial crisis has shown that relying only on micropurdential supervision on individual institutions and market disciplines is insufficient to detect and mitigate systemic risks. Supervisory authorities should adopt macroprudential measures through regulations and supervisions, i.e., macroprudential supervision policies to address sources of systemic risks, spillover channels of excessive leverages and maturity mismatches in order to maintain financial stability.

2.2 Structure of the Financial System in Chinese Taipei

This Section will give an overview of the structure of the financial system, monetary institutions and non-monetary institutions in Chinese Taipei. Its monetary institutions consist of domestic banks, foreign banks, and local branches of foreign banks, credit cooperatives, and other community financial institutions. The

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6. Testimony to the Joint Economic Committee in 1958, quoted in John B. Taylor (2010, p.168).

The Structure of the Financial System in Chinese Taipei

Monetary Institutions	Non-monetary Institutions
Domestic Banks (38) Foreign Banks (3) Local Banks (35)	Securities Firms (84) & Securities Financial Co. (2)
Local Branches of Foreign Banks (28)	Insurance Co. (54)
Credit Cooperatives (25)	Bills Finance Co. (8)
Credit Dept. of Farmers' Associations (277) Credit Dept. of Fishermen's Associations (25)	Post Co. Savings Department (1)
	Futures Firms (21)
	Financial Holding Companies (15)

Note: As of 31 July 2011.

instruments within the financial system include financial instruments and intermediary's instruments. The former mainly consist of equity, bond, and money markets instruments. The latter includes securities, futures, and life insurance.

The structure of the financial system also affects macroprudential surveillance. In the past decade, Chinese Taipei's financial system has undergone a structural change and borrowers have become more reliant on financial markets to raise funds. As funds increasingly flow through markets rather than banks, macroprodential policy may become less effective since its operations rely heavily on central bank's control over banks.

The CBC started to undertake banking examination when it resumed operations in 1961. The Central Deposit Insurance Corporation (CDIC) began to share the responsibility after its establishment in 1985. After 1991, the Ministry of Finance (MOF) also set up the Bureau of Monetary Affairs. In 2001, financial holding companies were given approval. As financial companies merged to form sub-sectors, boundaries within the financial sector were increasingly blurred. The supervisory framework with sub-sector-based division and responsibilities shared by three authorities was thus challenged. To consolidate the framework into one single organsation, the Financial Supervisory Commission (FSC) was inaugurated on 1 July 2004. After the establishment of the FSC, the CBC no

longer engages in general financial examination. Now it mainly conducts target examinations to fulfill its duties stipulated in the Central Bank of the Republic of China (Taiwan) Act.

2.3 Indicators for Macroprudential Surveillance

2.3.1 Aggregated Microprudential Indicators (FSIs)

The Financial Stability Indicators in *FSR of the CBC (Chinese Taipei)* is not designed to predict, but rather to reflect, current relative levels of systemic financial conditions. These data are collected from five sectors of the financial markets: credit markets, foreign exchange markets, equity markets, real estate markets and interbank markets, providing broad coverage of elements that may be indicators of financial situations. For example, the leverage ratios in the financial, corporate, and household sectors could reflect the stages of financial cycles.

However, the methodologies under FSI are, at their core, microprudential-the focus is on the stability of individual institutions (i.e., an aggregated microprudential indicators) and not macroprudential, where the focus is on systemic risks (i.e., interdependence and interactions between markets and institutions and interactions over time). In addition, FSI is basically a measure of current condition and largely ignores the likelihood of future deterioration. Taken together, we suggest that the methods are only illustrative - a "proof of concept" - in part because only publicly available data are used.

2.3.2 Macroeconomic Data

Weaknesses in an economy's macro economy pose a myriad of risks for the financial system, regardless of the interrelations and interaction between real and financial markets. The sources of risk can be broadly divided into three categories - macroeconomic conditions, financial sector risks, and international or external shocks of risk. In this connection, an economic recession may lead to an increase in market risks of the financial institutions; an increasing probability in loan defaults and bond downgrades[7] may affect the overall function of the

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7. The explosive growth of mortgage-backed securities (MBS) market lies at the heart of the global financial crisis. An empirical study of He et al. (2011) studies the role of the three primary rating agencies – Moody's, S&P, and Fitch - in the expansion of the MBS market. They concluded that the conflict of interest problem of rating agencies likely played a significant role in the evolution of the MBS markets.

financial system. Volatile financial market conditions and assets price bubbles can further lead to financial instability. Additionally, international and external exposures can also have a significant influence on financial stability.

Macro aggregates and forecasts (domestic, external, and sectored imbalances) are natural indicators of the state of business and financial cycles. The CBC regularly monitors the financial system and the overall economic and financial environment. The key economic and financial indicators in Annual Report of the CBC are published annually to reflect current economic and financial conditions. They include indicators such as business cycles indicators, national income statistics, prices, and monetary aggregates. It also includes charts and illustrations, making it more accessible to general readers.

2.3.3 Stress Tests and Scenario Analysis

A traditional stress test (or scenario analysis) starts from an extreme but plausible macroeconomic scenario and considers its one-off effect on banks (Sorge, 2004). Stress-testing approaches can help improve understanding of the nature and scale of risks to the financial system as a whole. Wilkinson et al. (2010) remarked, "Stress testing requires four steps: describe the risk to be modeled, design a stress scenario that incorporates the risk, model how the risk is transmitted to financial system and estimate the impact on the financial system." Clearly, experiments of this type of "what if" require some strong simplifying assumptions regarding the responses of financial firms and policymakers to shocks. Moreover, the results from these "bottom up" stress tests of system-wide scenarios by banks could be compared with the results from the "top down" stress tests conducted by Central Bank staff. The combined joint stress tests may shed light on potential system-wide feedback and interaction effects that can have a material impact, but which individual banks may find hard to assess.

Looking ahead, stress-testing frameworks could consider the two-way relationship between the financial system and the economy at large (Trichet, 2011). For example, severely weakened banks have less room for lending with negative effects on domestic demands. Meanwhile, cumulative effects and amplifications can take place in practice, which would not be captured by the traditional approaches. Therefore, the type of aggregate macro data and market-based indicators could also enrich stress-testing toolkits.[8]

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8. Survey results indicate that stress tests are among the most popular models being used. For an overview of stress testing approaches, see Cihak, Madrid, and Ong (2011).

2.3.4 Market Based Indicators (to Convey Market Perception on Health of Financial Institutions)

To provide a forward-looking perspective,[9] we can also look at market-based indicators in *FSR of the CBC)*, such as measures of distress dependence and the creditworthiness of individual firms using equity price (e.g. key international equity indices, TWSE, and OTC listed companies markets index and volatility) or credit default swap spread data (i.e., Sovereign CDS spreads in advanced economies); measures of tensions in the interbank market and risks in the banking sector using LIBOR-OIS spread[10] data. Other market-based indicators include stock index values, and interest rate spreads on subordinated debt issued by financial institutions.

The key market-based indicators are timely indicators. We Investigate indicators that serve as guides for current financial conditions and market risk profiles in both its time and cross-sectional dimensions. On the time dimension, indicators concerning the nature and causes of credit and asset price booms and busts will be crucial in formulating better policy, which include global and domestic economic growth rates, headline inflation rates, yield spread, movements of exchange rate against the US dollar, returns on equity and assets, etc. On the cross-sectional dimension, classified by financial sectors and by non-financial sectors, indicators include returns on equity and assets, NPL and capital adequacy ratios of domestic banks, housing price to income and mortgage burden ratio, etc.

It is important to note that, judged by the market-based indicators in FSR of 2011, while uncertainty continued to cloud the global growth outlook, Chinese Taipei's financial system remained stable. Most domestic financial institutions registered healthy profits and maintained sound asset quality alongside adequate capital levels. Still, precautionary measures are advised for financial institutions with high concentrations on real estate-related loans.

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9. Frederic S. Mishkin (1991) suggested five factors in the economic environment that can potentially lead to financial crises are (1) increases in interest rates, (2) stock market declines, (3) increases in uncertainty, (4) bank panics, and (5) unanticipated declines in the aggregate price level.

10. According to Taylor (2010), LIBOR-OIS spread is the difference between the interest rate on 3-month unsecured loans between banks (LIBOR) and an estimate of what the overnight interest rate will be, on average, over those same three months (OIS).

2.3.5 Qualitative Information on Institutional and Regulatory Framework (to Help Interpret Developments in Prudential Variables)

We may also identify risk based on qualitative indicators and analysis. It should be mentioned that policymakers would be unable to lean against the cycle effectively unless they can first identify the build-up of financial risks. As a consequence, many central banks have accessed supervisory evaluations or other qualitative indicators. Broadly speaking, we must rely on the insights and analysis of those preparing the evaluations and their expertise in detecting risks and assessing threats to financial stability.

Additionally, prudential policy needs to be set according to easily observable and reliable indicators. That is to say, each new financial cycle has unique as well as generic characteristics. Thus, policymakers will need to exercise judgment and give due weight to qualitative information when using financial measures to assess systemic risks.

2.4 The Use of FSIs as "Early Warning Signal"

The crisis has alarmed authorities sufficiently that early identification of the build-up of vulnerabilities and widespread imbalances has to be improved. The IMF (2011b) also demonstrated that financial stability indicators that seem the most promising and forward-looking measure from a financial stability standpoint, include credit-to-GDP gap measures, bank stability index, and the systemic CCA.

The Credit-to-GDP Gap: This measure has relatively strong performance in explaining the occurrence of macro financial shocks (Borio and Drehmann, 2009).

The Bank Stability Index: This index, and the associated Joint Probability of Default (JPoD), are among the tools that depicted well the rise in systemic risk ahead of the July 2007 crisis.

The Systemic CCA: It shows how risk affects the government's contingent claims over time, and gives a magnitude of expected losses in a forward-looking manner taking into account time-varying interdependence of financial firms.

The recent financial crisis highlighted the need to address systemic risk and provided an opportunity to assess the effectiveness of macroprudential

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surveillance. For example, even under Basel III (BCBS, 2010), individual banks will have to maintain higher and better-quality liquid assets and to better manage their systemic risks. However, because they target only individual banks, the Basel III liquidity rules can play only a limited role in addressing systemic liquidity risk concerns (IMF, 2011a).

Available evidence suggests that systemic risk is endogenous to the working of the financial system. Moreover, not all crises are alike and past experience is rarely a reliable guide to the future. Today, no tool has proved sufficiently reliable to predict financial stress and guide policymakers. At a more macro level, we must have adequate information to monitor systemic risk itself, and – what is more difficult – to promote early action in uncertain and controversial circumstances. Therefore, establishing a stronger early warning capacity is a major priority for further work.

3. Literature Review

3.1 Theories on Financial Instability

Back in 1990, Paul Volcker, the President of the Federal Reserve Bank (FRB), entitled his Per Jacobsson lecture "The Triumph of Central Banking?" which concluded that the credibility of central banks had improved. Also the economy of the 1990s inspired a misplaced belief that "the business cycle was no longer of practical importance" (Mankiw, 2006). And economists believed they had things under control and that the "central problem of depression-prevention has been solved," declared Robert Lucas in his 2003 presidential address to the American Economic Association. In the nearly two decades that followed, the triumph appeared to become more solid with moderate growth and stable inflation around the world. Goodhart (2010) had identified this epoch as "the triumph of the markets". Also some economists named it as "the Great Moderation" or "the Goldilocks Economy", meaning the economies were not too hot and not too cold.

But the question mark in the title of Volker's 1990 lecture was important. He remained, at heart, skeptical about how long lasting that success would be. The recent crisis has shaken the foundations of the central banking world. If one had to choose a fitting title for a corresponding lecture today, it would probably be, "the doubts of central banking?" (Borio, 2011). After the crisis, the certainties of the Great Moderation have gone with the wind. That is, price stability of the monetary policy mandate has proven no guarantee against major financial and macroeconomic instability.

Views of financial instability have been developed by Charles Kindleberger and Hyman Minsky (Minsky, 1974). The "Financial Instability Hypothesis" is an interpretation on self-sustaining disequilibrating processes by Kindleberger (1978), namely, "Manias, Panics and Crashes". Minsky (1992) proposed theories linking financial market fragility in an economy with speculative investment bubbles endogenous to financial markets. He pointed out that a fundamental characteristic of our economy is that the financial system swings are an integral part of the process that generates business cycles. The hypothesis also argued that the booms/busts of credit cycles are inherent in a free market economy – unless government steps in to control the situations, through regulation, policy measures and other central bank actions. In particular, the crisis was global in nature, reflecting the ever-increasing interconnectedness of financial markets and institutions around the world. Besides, the downturn raised the odds that the recession will be prolonged, since neither we nor our trade partners can look to a boost from foreign demand (Yellen, 2009).

Up until recently, Caruana (2010) found that the major lesson of the recent financial crisis was that we all failed to correctly interpret systemic risk. He found that first, the financial system's tendency to amplify the ups and downs of the real economy, that is, procyclicality, was underestimated. Second, the full impact of interlinkages and common exposures across the financial system, that is, system-wide disruptions, was not properly appreciated.

3.2 Studies on Aggregated Microprudential Indicators

Following the traditional economic doctrine, there is a dichotomy between monetary policy and financial stability policy in which these two types of policies are conducted separately (Mishikin, 2011). Monetary policy aims at maintaining price stability and (micro-) prudential supervision to secure financial stability. The spirit is best captured by the motto "the whole financial system is sound if and only if each institution is sound" (Borio, 2003). The individual bank is the natural starting point and aggregated microprudential supervision is the end point of that approach.

It is widely acknowledged that financial stability is a public good. Financial regulations in almost all countries are designed to ensure the soundness of individual financial institutions against the loss on their assets, and have sufficient capital and liquidity to absorb shocks to their loan portfolios and funding, and are

well managed and avoid excessive risk[11] (in particular, Pillar 1 minimum capital regulation and Pillar 2 supervisory review process of Basel II).

Additionally, as Akerlof (1970) "The Market of Lemons" has shown, in the market where participants have asymmetric information, moral hazard and adverse selection reducing exchange at below levels; it would be beneficial if market participants (depositors and investors) had better information (i.e., Pillar 3 market discipline of Basel II). In addition, the financial system is sensitive to market failure, and the consequences of such failure justify government intervention. This argues in favour of regulatory authorities to preserve potentially solvent institutions as going concerns, or else to intervene to gradually wind down banks that have become insolvent (Crockett, 1997).

Before the crisis, apart from CAMELS-like aggregated microprudential indicators (e.g., bottom-up indicators of Basel II), the IMF has suggested a list of financial stability indicators (FSI) designed to assess the financial health of an economy's banking system, nonbank financial intermediaries, and the nonfinancial sectors of the economy (Sundararajan et al., 2002). To supervisors charged with alleviating financial instability, these are useful information. However, the methodologies under FSI are micro- and not macro-prudential surveillance. In addition, FSI is basically a measure of the current condition and largely ignores the likelihood of future deterioration. It is clear that the traditional financial stability indicators need to be updated and strengthened. After the crisis, we must focus on macroprudential surveillance of system risks.

A key part of developing macroprudential indicators is to adapt existing microprudential indicators. Besides, the new macroprudential indicators need to be developed to allow us to better anticipate the risks that threaten the smooth functioning of the financial system. For example, an empirical study of Mathias and Drehmann (2011) explored three model-based measures of systemic

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11. Traditionally, the Federal Deposit Insurance Corporation of US and other financial institution regulators use the Uniform Financial Institutions Rating System (UFIRS) to evaluate a bank's performance. Areas of financial and operational concern are evaluated and given a numerical rating of "1" through "5," with "1" having the least concern and "5" having the greatest concern. The performance areas, identified by the acronym CAMEL(S), are Capital Adequacy, Asset Quality, Management, Earnings, and Liquidity. A sixth component, Sensitivity to market risks was added in December 1996. Positive changes in the average composite CAMELS rating for banks indicate a widespread decline in banks' safety and soundness because the rating is an ordinal index that increases in value the poorer a bank's assessed safety and soundness. Similarly, the CBC modified the CAMELS standard to CARSEL, in which "R" stands for Regulations Compliance and "S" for Strategies and Stability, respectively.

importance[12] and found that bank size (i.e. too big to fail) helps approximate each of them. A bank's total interbank lending and borrowing (i.e. too connected to fail) provided useful complementary information. The results suggested that the simple indicator approach might be the most suitable route for practical purpose. It is because they are simple, readily available and reliable proxies for the more sophisticated measures.

3.3 Studies on Macroeconomic and Market Based Variables

In principle, market-based indicators give a forward-looking perspective, reflecting the views of many highly motivated market participants. Compared to common financial indicators and ratios, market-based indicators are timelier because they are based on investor expectations rather than on accounting data that may be dated (Wilkinson and others, 2010). However, Borio (2006) suggested that market indicators of risk, such as price earnings ratios and credit spreads, tend to be relatively low close to the peak of the financial cycle. And this is precisely when, at least in hindsight, risk is highest. Markets behave as if risk fell in boom and rose in recessions. Attention is called to the monitoring of performance based on short-term market benchmarks.

The IMF research paper concluded that views on leading indicators diverge, and a few indicators are identified as leading indicators and used operationally as the basis for macroprudential policy decisions (IMF, 2011a). The most frequently cited forward looking indicator is credit growth or credit to GDP. For example, Caruana (2010) suggests that implied indicators based on simultaneous deviations of the credit-to-GDP ratio and asset prices of the market from historical norms can signal financial distress years ahead with fair accuracy.

4. Framework for Macroprudential Indicators Analysis

4.1 Specification of Aggregated Microprudential Indicators (FSIs in Accordance with IMF Guide)

In 2010, the recovery of both global and domestic economies proceeded but the global financial system remained fragile because of sovereign debt pressures in the Euro Zone. However, the financial system in Chinese Taipei remained stable. Payment and settlement systems operated smoothly, and financial markets

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12. Similarly, the result of a BIS-FSB-IMF survey of 2009 suggests that systemic importance depends on at least three factors: size, interconnectedness and substitutability (Caruana, 2010).

continued to function normally. Benefiting from accumulated earnings, the regulatory capital to risk-weighted assets peaked at 11.96 percent at the end of 2011. Most domestic financial institutions registered healthy profits alongside adequate capital level (Table 1).

The following sections will give a broad picture of the financial soundness indicators (FSIs) in Chinese Taipei. It should be stressed that items listed in FSIs are compiled in accordance with Compilation Guide issued by the IMF in July 2004.

4.1.1   FSIs for Deposit Takers

To supervisors charged with alleviating financial instability, CAMELS-like aggregated financial stability indicators are used to assess the financial health of Chinese Taipei's banking system. In recent years, the regulatory capital adequacy ratios for domestic banks were well above Basel minimum requirement of 8 percent, showing that the leveraged growth of deposit takers are under general regulations and still satisfactory (Chart 1).

Chart 1
Capital Adequacy Ratios for Domestic Banks
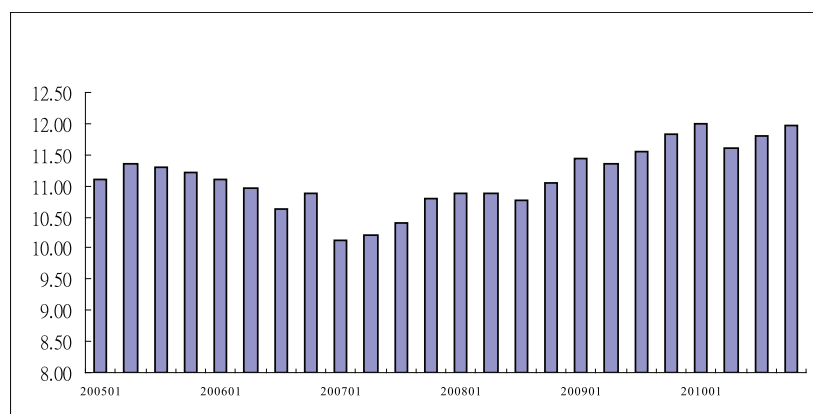
Source: Financial Stability Report, May 2011, Central Bank, Chinese Taipei.

Table 2
FSIs for Deposit Takers in Chinese Taipei

Unit : %

Items	2005	2006	2007	2008	2009	2010
Capital adequacy						
Regulatory capital to risk-weighted assets	11.23	10.87	10.80	11.04	11.83	11.96
Tier 1 capital to risk-weighted assets	10.37	9.88	8.50	8.42	9.03	9.17
Asset quality						
Banks' non-performing loans to total loans	2.24	2.15	1.83	1.54	1.15	0.61
Banks' provision coverage ratio	50.06	62.26	64.07	69.48	90.35	157.32
Earnings and profitability						
Banks' return on assets (ROA)	0.30	-0.06	0.28	0.12	0.28	0.57
Banks' return on equities (ROE)	4.74	-0.94	4.32	1.86	4.52	9.08
Liquidity						
Liquid assets* to total assets	-	-	10.58	12.69	15.20	10.46
Liquid assets* to short-term liabilities	-	-	15.66	18.39	20.98	14.65

Notes: The items with * are only available from 2007.
Source: Financial Stability Report, May 2011, Central Bank, Chinese Taipei.

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4.1.2   FSIs for Financial and Non-financial Markets

4.1.2.1   FSIs for Equity Markets

Underpinned by the emerging effects of signing the ECFA (Cross-Strait Economic Cooperation Framework Agreement) and economic recovery, the Chinese Taipei Stock Market Exchange Weighted Index (TAIEX) kept climbing in 2010 (Chart 2). The TAIEX experienced a temperate drop in the second quarter due to spillovers from the European sovereign debt crisis, and climbed to its highest at the end of December, an increase of 27 percent compared to the low of June. Meanwhile, Chinese Taipei's GreTai Securities Market (GTSM) Index of the OTC market closely tracked the movements of the TAIEX.

Chart 2
TWSE Market Index
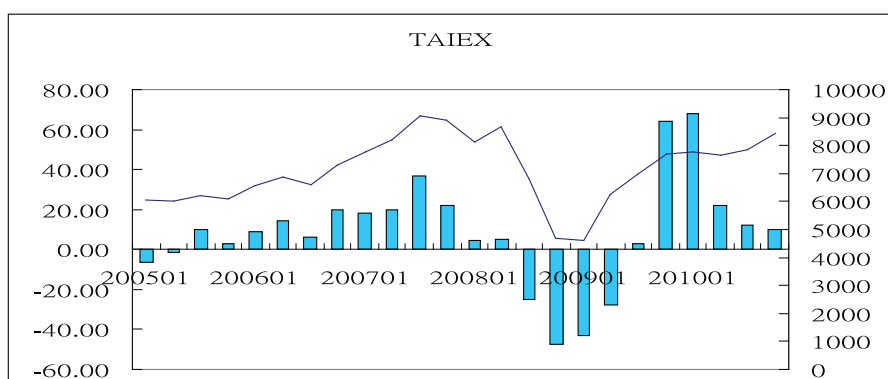
Source: Financial Stability Report, May 2011, Central Bank, Chinese Taipei.

The TWSE and OTC markets were moderately active in 2010. The average monthly trading value on the TWSE market was NT$2.35 trillion, a moderate decrease of 4.93 percent year-on-year, while its turnover ratio in terms of trading value decreased to 136.74 (Table 2).

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Table 2
FSIs for Equity Markets in Chinese Taipei

Unit: %

Items	2005	2006	2007	2008	2009	2010
Total liabilities to equity						
TWSE-listed companies	66.06	64.27	63.28	67.54	65.43	69.01
OTC-listed companies	84.03	74.17	78.21	89.56	62.75	72.17
Return on equity						
TWSE-listed companies	10.88	13.04	13.90	4.76	8.07	
OTC-listed companies	14.13	15.34	18.04	8.08	9.58	16.95
Net income before interest and tax / interest expenses (times)						
TWSE-listed companies	15.25	16.85	19.07	8.26	15.03	33.07
OTC-listed companies	8.38	14.06	6.79	-	10.85	21.38
Market Liquidity						
TWSE turnover ratio	131.36	142.20	153.28	145.45	178.28	136.74
The average turnover ratio in bond market	215.69	140.58	74.65	47.93	31.56	32.40

Notes: 1.The turnover ratio of trading value in stock market is the cumulative figure of the period.
　　　2. The monthly average turnover ratio in bond market is the average figure of the period.
Source: Financial Stability Report, May 2011, Central Bank, Chinese Taipei.

4.1.2.2 FSIs for Non-financial Corporations (Corporate Sector)

The corporate sector, household sector, and real estate market constitute the main sources of credit exposure of Chinese Taipei's financial institutions. From the second half of 2009 onward, overall profitability of the corporate sector improved amidst gradual recovery of the global and domestic economies. The return on equity (ROE) ratio for the corporate sector increased to 8.07 percent in 2009 as TWSE-listed and OTC-listed companies' ROEs rose to 9.58 percent and 6.91 percent, respectively (Table 3).

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Table 3
FSIs for Non-financial Corporate Sector in Chinese Taipei

Unit: %

Items	2005	2006	2007	2008	2009	2010
Total liabilities to equity	86.10	85.21	82.20	90.02	86.88	
Return on equity	10.88	13.04	13.90	4.76	8.07	
Net income*	8.97	10.10	10.78	3.39	8.54	

Notes: * *Net income before interest and tax / interest expenses (times).*
Source: Financial Stability Report, May 2011, Central Bank, Chinese Taipei.

4.1.2.3 FSIs for Households

The household debt burden eased and debt servicing capacity strengthened as disposable income expanded faster than borrowing. Following booming local real estate market, total household borrowing at the end of 2010 reached NT$11.19 trillion. The largest share of household borrowing went for the purchase of real estate (75.25 percent). The ratio of household borrowing to GDP dropped to 82.7 percent at the end of 2010, mainly due to a much faster pace in GDP growth (Table 4).

Table 4
FSIs for Households in Chinese Taipei

Unit: %

Items	2005	2006	2007	2008	2009	2010
Household borrowing/GDP	83.15	83.17	81.47	81.92	84.84	82.17
Borrowing service and principal payments to gross disposable income	46.97	44.66	42.09	40.74	37.29	36.12

Notes: The figures of disposable income for 2010 are CBC estimates.
Source: Financial Stability Report, May 2011, Central Bank, Chinese Taipei.

4.1.2.4 FSIs for Real Estate Market

Inspired by the signing of the ECFA and the status upgrading of five cities, the housing prices of real estate market surged in 2010. The mortgage burdens in specific areas near Taipei City and New Taipei City also elevated. In response to surging housing prices, the CBC, the Ministry of Finance (MOF), and the Financial Supervisory Committee (FSC) have adopted a series of prudential measures with the aim of urging financial institutions to enhance risk management so as to promote financial stability. The residential real estate loans to total loans decreased to 29.99 percent from 30.57 percent a year before (Table 5).

Table 5
FSIs for Real Estate Market in Chinese Taipei

Unit: %

Items	2005	2006	2007	2008	2009	2010
Land price index	94.68	96.38	98.92	100.51	100.38	105.93
Residential real estate loans* to total loans	-	29.14	30.14	29.16	30.57	29.99
Commercial real estate loans* to total loans	-	10.74	11.84	12.14	12.47	13.25

Notes: 1. Figures of land price index are on an end-September basis (March 2008 = 100).
2. The items with * are only available from 2006.
Source: Financial Stability Report, May 2011, Central Bank, Chinese Taipei.

4.2 Specification of Macroeconomic and Market Based Variables

4.2.1 Economic Growth and Inflation

Over the year of 2010, global financial stability was still not secured. The world economy has improved but still fragile, affected by the slow growth prospects and weak fiscal positions, together with sovereign debt crisis driven financial pressures in the Euro Zone. On the other hand, the domestic economic growth sustained at a high level of 10.88% (Chart 3 bar, LHS) in 2010 alongside moderate inflation (Chart 3 and Table 6).

Table 6
Main Economic Indicators in Chinese Taipei

Unit: %

	2005	2006	2007	2008	2009	2010
GDP growth rate	4.70	5.44	5.98	0.73	-1.93	10.88
CPI growth rate	2.31	0.60	1.80	3.53	-0.87	0.96

Note: Figures for 2010 is DGBAS preliminary estimates.
Source: DGBAS.

Chart 3
Economic Growth Rate and Inflation Rate in Chinese Taipei

Source: DGBAS.

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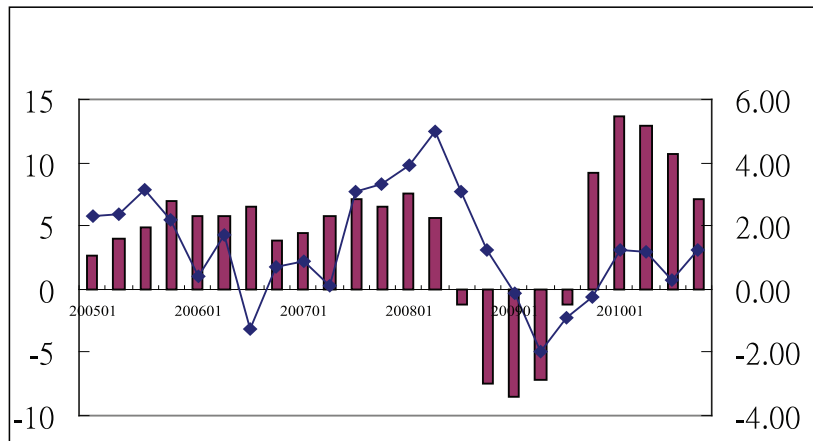
4.2.2 Balance of Payment

Chart 4
Current Account Surpluses in Chinese Taipei
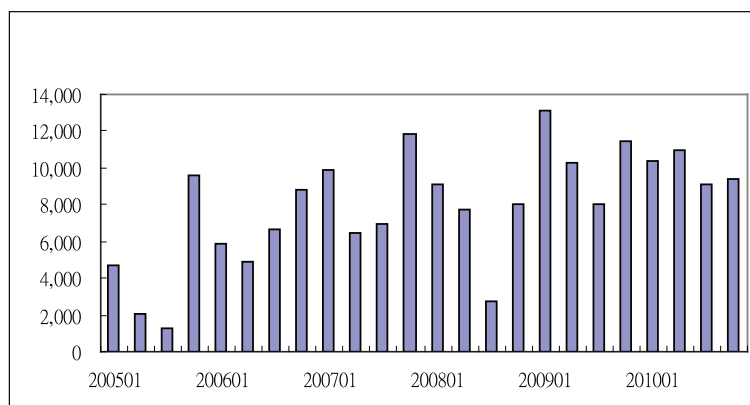
Source: DGBAS.

Chinese Taipei is a small, open economy that is highly dependent on external trade. In 2010, thanks to the ongoing global recovery and solid growth in Asian economies, Chinese Taipei exports and imports both saw visible increases. Despite the fact that the trade surplus was slightly lower than a year earlier as the growth in imports was larger than that of exports, the current account surplus registered US$40.62 billion throughout the whole of 2010, or 9.44 percent of annual GDP (Chart 4).

4.2.3 Interest and Exchange Rates

Regarding market interest rates, short-term and long-term rates stayed flat in the first half of 2010. In the second half of 2010, short-term interest rate escalated steadily following gradual rise in CBC's policy rates (Chart 5 bar, LHS). The NT dollar exchange rate (Chart 5 line, RHS) appreciated notably but remained relative stable compared to other currencies (Chart 5).

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Chart 5
Interest and NT Dollar Exchange Rates in Chinese Taipei
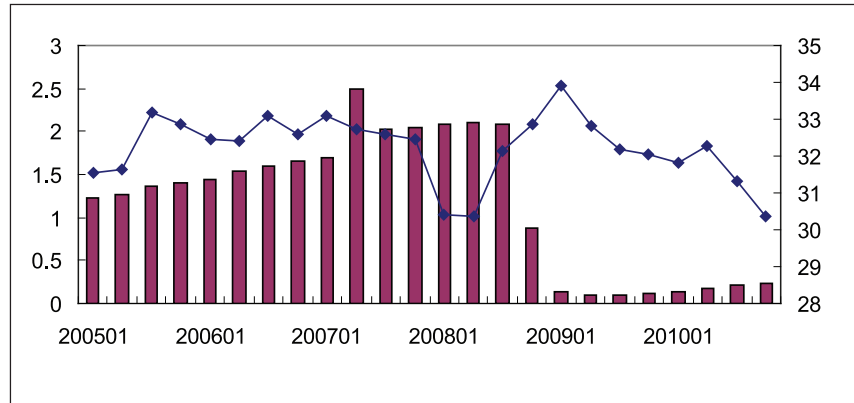
Source: Financial Stability Report, May 2011, Central Bank, Chinese Taipei.

4.2.4   Lending and Asset Price Booms (Asset Bubble Study, SEACEN 2010)

Chart 6
Housing Price Indicators in Chinese Taipei
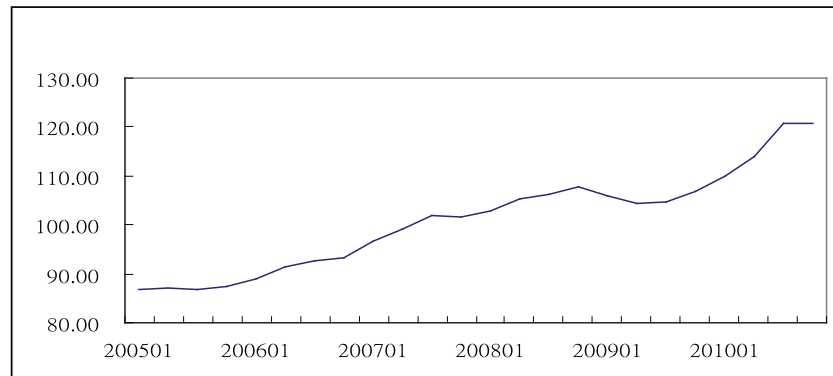
Source: Financial Stability Report, May 2011, Central Bank, Chinese Taipei.

Real estate prices kept soaring alongside a buoyant property market (Chart 6), inspired by the effects of signing the ECFA and hot money inflows in 2010. Chinese Taipei's real estate cycle indicators showed a yellow/red light, indicating of a "moderately heated" market.

5. Strengthening Financial Stability Indicators

5.1 Specifications of the VAR Model

The financial crisis has posed new and significant challenges to central banks. Financial sector risks can stem from problems of common exposures at financial institutions, volatile mar-ket conditions, asset price bubbles, and weaknesses in the macroeconomic environments. Bank panics are not random events. Gorton (1988) suggests that movements in variables predicting economic recessions cause panics.

To examine whether macroeconomic and market-based data have driven significant impact on the FSIs, we choose the traditional vector autoregression (VAR) model following Sims (1980) because of the VAR approach sidesteps the need for structural modeling (see Hou, 2008). In addition, the advantage of VAR approach is that it provides a natural way to evaluate the interactions and shocks of the key macroeconomic and market based variable of interest, even when mis-specified (Christiano et al., 2006).

For simplicity, we develop the system involving seven variables for VARs in the following order (see variables of interest listed below): TWSE stock index (STK), exchange rate against the US dollar (ER), housing price (REKT), money supply M2 (M2), gross domestic product (GDP), consumer price index (P), and capital adequacy ratio (CAR). Then we perform the unit root test to follow up.

Table 7
Data Specifications

Notation	Variable Specification	Data Source
STK	Stock market index	*Financial Statistics Monthly*
ER	Exchange rates: NTD/USD	*Financial Statistics Monthly*
REKT	Housing price	Supervisory Database, CBC
M2	Money supply M2	*Financial Statistics Monthly*
GDP	Real GDP	*Quarterly Economic Trends*
CPI	Consumer price index	*Price Statistics Monthly*
CAR	Capital adequacy ratio	Supervisory Database, CBC

Notes: Financial statistics databases of Chinese Taipei in AREMOS, and supervisory databases of CBC.

5.2 Results of the Empirical Study

For spurious correlations concerns (Philips, 1986), we first examine the stationarity of each stochastic variable. Two standard tests for the stationary process, Augmented Dickey-Fuller (ADF) tests and Phillips-Perron (PP) tests are applied to examine the null of the unit roots in each variable. The computer software applied is Eviews7. All specifications include a constant term, either with or without a trend, and up to five lags. The sample period consists of quarterly data from the first quarter of 2005 to the fourth quarter of 2010, and data sources include financial statistics databases of Chinese Taipei in AREMOS and supervisory databases of CBC.

It appears that part of the ADF test results is not sensible economically. We perform the Phillips-Perron unit root tests to follow up. The ADF and PP test statistics are shown in Table 7 and 8, respectively. By the results in Table 8, the nonstationary null hypothesis of the unit roots for most of the level variables cannot be rejected. For M2 in particular, ADF test statistics with drift suggests that it is I(0) at a 1 percent significance level. However, first differences of all variables appear to be stationary with the rejection of the unit root hypotheses at a 5 percent significance level, except M2. By the PP test statistics result in Table 9, first difference of M2 is stationary at a 1 percent significance level except ER is stationary at a 10 percent significance level. Therefore, first differences of all seven variable series in our sample are integrated of order zero, I(0). Visually, all seven level series appear I(1) and all seven first different variables series appear I(0).

Table 8
ADF Unit Root Tests

Level	τ_μ	τ_τ	Difference	τ_μ	τ_τ
STK	-1.97 (0.3001)	-1.93 (0.6186)	D(STK)	-5.78*** (0.0000)	-5.69*** (0.0000)
ER	-2.25 (0.1934)	-1.39 (0.8465)	D(ER)	-3.04** (0.0411)	-3.61** (0.0442)
REKT	-0.18 (0.9316)	-2.20 (0.4743)	D(REKT)	-7.49*** (0.0000)	-7.36*** (0.0000)
M2	-0.24 (0.9707)	-5.94*** (0.002)	D(M2)	-2.33 (0.1682)	-2.38 (0.3798)
GDP	-2.66* (0.0914)	-2.34 (0.4032)	D(GDP)	-9.72*** (0.0000)	-9.79*** (0.0000)
CPI	-1.76 (0.3937)	-1.59 (0.7756)	D(CPI)	-6.06*** (0.0000)	-6.27*** (0.0000)
CAR	-2.14 (0.2307)	-1.73 (0.7166)	D(CAR)	-4.83*** (0.0004)	-4.21*** (0.0124)

Notes: 1. τ_μ, Exogenous: Constant; τ_τ, Exogenous: Constant with Linear Trend. 2. Numbers in parentheses are MacKinnon (1996) one-sided p-values. 3. *** Indicates significant at 1%, ** Significant at 5%, and * Significant at 10%. 4. Lag Length: 5 (Automatic selection based on Schwarz Information Criterion, MAXLAG=5).

Table 9
Phillips-Perron Unit Root Tests

Level	τ_μ	τ_τ	Difference	τ_μ	τ_τ
STK	-2.04 (0.2705)	-2.00 (0.5801)	D(STK)	-5.79[***] (0.0000)	-5.69[***] (0.0002)
ER	-2.62[*] (0.0983)	-0.78 (0.9584)	D(ER)	-2.92[*] (0.0536)	-3.52[*] (0.0535)
REKT	-0.12 (0.9388)	-2.20 (0.4743)	D(REKT)	-7.47[***] (0.0000)	-7.34[***] (0.0000)
M2	-0.24 (0.9716)	-1.33 (0.8633)	D(M2)	-4.90[***] (0.0003)	-4.95[***] (0.0017)
GDP	-2.82[*] (0.0653)	-2.75 (0.2258)	D(GDP)	-9.72[***] (0.0000)	-9.56[***] (0.0000)
CPI	-1.76 (0.3931)	-1.60 (0.7724)	D(CPI)	-6.06[***] (0.0000)	-6.27[***] (0.0001)
CAR	-2.14 (0.2307)	-1.73 (0.7166)	D(CAR)	-4.75[***] (0.0005)	-4.85[***] (0.0022)

Notes: 1. τ_μ, Exogenous: Constant; τ_τ, Exogenous: Constant with Linear Trend. 2. Numbers in parentheses are MacKinnon (1996) one-sided p-values. 3. *** Indicates significant at 1%, ** Significant at 5%, and * Significant at 10%. 4. Bandwidth: 2 (Newey-West using Bartlett Kernel spectral estimation method)

We conduct the VAR model estimation (see Appendix) and perform the impulse response function analysis and variance decomposition analysis directly. Following the traditional convention, we select the year-on-year changes of all variables to reduce the effect of seasonality, except the CAR is an original series. Empirically, the impulse response results of the VAR model simulations are difficult to interpret; we use variance decomposition result instead (see Table 10).

An interesting finding from Table 10 is that asset prices including stock price (STKDOT) and real estate price (REKTDOT) account for almost half (line 10) the effects to the variance decompositions of capital adequacy ratio (CAR). It shows that asset prices are the dominated factors to affect the financial stability indicator, CAR, in the near- to medium-term (10 quarters).[13]

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13. However, there are potential sources of uncertainty associated with these quantitative impact estimates. These include: *First*, estimation errors refer to the uncertainty around reduced-form estimates of the VAR model. *Second*, lack of data and degree of freedom are an acute problem for quantitative financial stability analysis. Taken together, this implies that there is a high degree of intrinsic uncertainty about the quantitative measure here. As a consequence, the results are only broadly suggestive.

Table 10
Variance Decomposition Effects

Variance Decomposition of CAR:								
Period	S.E.	STKDOT	ERDOT	REKTDOT	M2DOT	YDOT	PDOT	CAR
1	0.276047	23.39207	0.155247	16.48859	0.177668	0.002393	11.95277	47.83127
2	0.449512	24.93198	4.194178	32.78913	0.601587	0.022989	6.535272	30.92487
3	0.545803	18.44247	3.557104	34.92636	2.378729	0.23408	11.40227	29.05899
4	0.620443	16.71911	3.921509	34.75813	4.255807	1.473387	9.955825	28.91623
5	0.659052	15.22738	5.393734	33.64283	7.196251	1.364788	10.1854	26.98962
6	0.671392	14.76329	5.462602	32.5734	8.44333	1.398652	10.96703	26.3917
7	0.679569	14.47794	5.365596	32.6437	9.198331	1.372301	11.17398	25.76815
8	0.690911	14.06798	5.193043	33.4655	8.98106	1.661945	11.2612	25.36928
9	0.712021	14.27228	4.953281	34.7379	8.469653	1.597712	10.60608	25.3631
10	0.727876	**14.41697**	4.918927	**34.71661**	8.10691	1.570278	10.15171	26.1186
Cholesky Ordering: STKDOT ERDOT REKTDOT M2DOT YDOT PDOT CAR								

6. Policy Recommendations

Central banks have an important role to play in the development of macroprudential supervision. At the same time, the macroprudential policy requires that central banks take preemptive actions to mitigate impacts of financial crises. Trichet (2011) remarked that the crisis has taught us that early identification of the build-up of vulnerabilities and widespread imbalances has to improve. With timely information, it may be possible to take ac-tions to address such threats before they cause problems.

Hardly anyone disputes that the crisis is best seen as the bust of a major financial cycle whose upswing saw a major expansion in credit and asset prices, especially those of real estate and stock markets. Leverage grew on the back of aggressive risk-taking. The boom did not just precede, but caused the subsequent bust, as the Financial Instability Hypothesis had suggested. Post-crisis central banking requires adjustments to current policy frameworks for the build-up of financial imbalances even in the context of low and stable inflation.

Promoting financial stability is no easy task. At a minimum, we need better analytical frameworks and better technical tools. To limit the destructive boom and bust of financial cycles, it is shown by the empirical evidence aforementioned that indicators of asset price bubbles are essential, at least in Chinese Taipei's case. We survey this evidence, and add a few calculations of our own. Overall, the result suggests that asset prices have a strong effect on aggregated capital adequacy ratio of the financial system, although the impact may shift over time.

According to the classic Poole (1970) analysis, a central bank should "lean against the wind" for significant asset price movements. The policy recommendation is clear. Central bankers must keep an eye on asset price developments, and sometimes act in response to these developments. Cihak, et al. (2012) concluded that a major drawback of an economy's FSR is the lack of "forward-lookingness" of the reports, making it less capable of assessing systemic risk. In this paper, we propose a list of a "precautionary set" of market-based and macroeconomic indicators including asset prices (e.g., stock prices and housing prices) to be incorporated in the Financial Soundness Indicators. Credit-to-GDP ratios (Caruana, 2010) and LIBOR-OIS spread (Taylor, 2010) are also recommended.

7. Conclusion

In recent years, innovations in financial products and practices have altered the roles of traditional financial intermediaries. Central banks regulatory and supervisory responses should be as dynamic as the financial intermediaries while adhering to the long-standing objectives to promote financial stability.

As central bankers, we should continually review the changing financial landscape. But how can a central banker, in this environment, make its supervision tasks operational? In general, our regulatory frameworks should not be based on individual institutions. Rather, we should strive to develop macroprudential policies based on the financial system as a whole. Gonzalez-Paramo (2010) remarked that *first,* the governance of the macroprudential framework needs to be carefully designed; *second,* an operational framework for macroprudential analysis and policy needs to be defined. Since defining financial stability is difficult, there is no simple quantitative definition or a single indicator against which to be held accountable. Strengthening financial stability indicators in the midst of rapid financial innovation is the first step forward. It's not so much where we stand, but in what direction we're moving.

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Vector Autoregression Estimation

Vector Autoregression Estimates							
Date: 01/04/12 Time: 14:29							
Sample: 2005Q1 2010Q4							
Included observations: 24							
Standard errors in ( ) & t-statistics in [ ]							
	STKDOT	ERDOT	REKTDOT	M2DOT	YDOT	PDOT	CAR
STKDOT(-1)	-0.28898	0.03402	-0.00469	-0.01947	-0.0186	0.00597	0.000556
	-0.32979	-0.09042	-0.04787	-0.01629	-0.05829	-0.02685	-0.009
	[-0.87626]	[0.37626]	[-0.09796]	[-1.19556]	[-0.31901]	[0.22232]	[0.06185]
STKDOT(-2)	0.098989	0.085809	0.045445	-0.01157	0.120632	0.014211	0.000952
	-0.30394	-0.08333	-0.04412	-0.01501	-0.05373	-0.02475	-0.00829
	[0.32569]	[1.02975]	[1.02998]	[-0.77080]	[2.24535]	[0.57420]	[0.11478]
ERDOT(-1)	-0.76815	0.470057	0.025875	0.004001	-0.0981	-0.17358	-0.02672
	-0.7335	-0.2011	-0.10648	-0.03622	-0.12966	-0.05973	-0.02001
	[-1.04724]	[2.33741]	[0.24300]	[0.11047]	[-0.75663]	[-2.90608]	[-1.33513]
ERDOT(-2)	0.144818	-0.44919	-0.07729	-0.07613	0.206481	0.050297	0.012205
	-0.87743	-0.24056	-0.12737	-0.04333	-0.1551	-0.07145	-0.02394
	[0.16505]	[-1.86726]	[-0.60676]	[-1.75707]	[1.33130]	[0.70396]	[0.50985]
REKTDOT(-1)	-1.90099	-0.3871	0.409997	-0.13932	-0.36077	-0.23295	0.101154
	-1.74725	-0.47904	-0.25365	-0.08628	-0.30885	-0.14228	-0.04767
	[-1.08799]	[-0.80808]	[1.61642]	[-1.61466]	[-1.16809]	[-1.63729]	[2.12202]
REKTDOT(-2)	1.137267	-0.15056	-0.25775	0.075177	0.615216	0.382944	-0.05767
	-2.0156	-0.55261	-0.2926	-0.09953	-0.35629	-0.16413	-0.05499
	[0.56423]	[-0.27245]	[-0.88088]	[0.75530]	[1.72675]	[2.33318]	[-1.04867]
M2DOT(-1)	4.859263	3.933896	-0.66797	0.568488	1.945887	0.306317	-0.05828
	-5.75709	-1.5784	-0.83575	-0.28429	-1.01764	-0.4688	-0.15707
	[0.84405]	[2.49233]	[-0.79925]	[1.99967]	[1.91215]	[0.65341]	[-0.37103]
M2DOT(-2)	-4.38071	-3.85054	0.16686	0.072695	-0.73121	-0.34594	0.071748
	-4.85349	-1.33066	-0.70457	-0.23967	-0.85792	-0.39522	-0.13241
	[-0.90259]	[-2.89370]	[0.23682]	[0.30331]	[-0.85231]	[-0.87531]	[0.54184]
YDOT(-1)	7.883705	-0.14017	-0.1865	-0.08623	1.228091	0.253449	0.000231
	-1.9324	-0.5298	-0.28052	-0.09542	-0.34158	-0.15735	-0.05272
	[4.07976]	[-0.26456]	[-0.66481]	[-0.90364]	[3.59535]	[1.61070]	[0.00439]
YDOT(-2)	-4.38846	0.036799	0.483695	0.153316	-0.69462	-0.14913	-0.07551
	-1.49074	-0.40871	-0.21641	-0.07361	-0.26351	-0.12139	-0.04067
	[-2.94380]	[0.09004]	[2.23510]	[2.08269]	[-2.63601]	[-1.22851]	[-1.85661]

PDOT(-1)	-5.46443	-0.56374	-0.57388	-0.37613	0.339291	-0.10532	-0.02441
	-2.9245	-0.8018	-0.42454	-0.14441	-0.51695	-0.23814	-0.07979
	[-1.86850]	[-0.70310]	[-1.35175]	[-2.60450]	[0.65634]	[-0.44225]	[-0.30588]
PDOT(-2)	-5.40084	0.110989	-0.8011	0.050295	-0.44702	0.374999	0.139546
	-3.2326	-0.88627	-0.46927	-0.15963	-0.57141	-0.26323	-0.08819
	[-1.67074]	[0.12523]	[-1.70712]	[0.31507]	[-0.78231]	[1.42461]	[1.58228]
CAR(-1)	-3.87718	-1.50759	-0.92754	-0.26898	0.791426	0.761198	0.845223
	-9.29028	-2.54708	-1.34865	-0.45876	-1.64219	-0.7565	-0.25346
	[-0.41734]	[-0.59189]	[-0.68775]	[-0.58632]	[0.48193]	[1.00621]	[3.33474]
CAR(-2)	-16.3145	-2.02829	-0.19421	0.935841	-0.23778	-1.6949	0.156826
	-13.4451	-3.68619	-1.9518	-0.66393	-2.37661	-1.09483	-0.36681
	[-1.21341]	[-0.55024]	[-0.09950]	[1.40954]	[-0.10005]	[-1.54810]	[0.42754]
C	234.9235	41.36654	20.23019	-4.78953	-12.0596	10.09995	-0.19744
	-111.228	-30.4949	-16.1467	-5.49254	-19.6611	-9.05721	-3.03455
	[2.11209]	[1.35651]	[1.25290]	[-0.87201]	[-0.61337]	[1.11513]	[-0.06506]
R-squared	0.945194	0.857721	0.953176	0.969268	0.963015	0.909871	0.888155
Adj. R-squared	0.859939	0.636399	0.88034	0.921464	0.905482	0.769671	0.714174
Sum sq. resids	921.4002	69.25905	19.41739	2.246818	28.78957	6.109574	0.685819
S.E. equation	10.11819	2.774067	1.468839	0.499646	1.78853	0.823918	0.276047
F-statistic	11.08673	3.875434	13.08651	20.27557	16.73853	6.489808	5.104888
Log likelihood	-77.8286	-46.7721	-31.5119	-5.63206	-36.238	-17.6362	8.607823
Akaike AIC	7.735718	5.147677	3.875993	1.719338	4.269836	2.71968	0.532681
Schwarz SC	8.472001	5.883961	4.612276	2.455622	5.00612	3.455964	1.268965
Mean dependent	8.212917	-0.78458	5.588333	5.19625	4.380417	1.377083	11.13125
S.D. dependent	27.03612	4.600491	4.246191	1.782901	5.81753	1.716763	0.516336
Determinant resid covariance (dof adj.)	1.303226						
Determinant resid covariance	0.001359						
Log likelihood	-159.17						
Akaike information criterion	22.01418						
Schwarz criterion	27.16816						