The **SEACEN** Centre

Framework for Macro-prudential Policies for Emerging Economies in a Globalized Environment

Edited by

Eufrocinio M. Bernabe, Jr.

FRAMEWORK FOR MACRO-PRUDENTIAL POLICIES FOR EMERGING ECONOMIES IN A GLOBALIZED ENVIRONMENT

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Kuala Lumpur, Malaysia

FOREWORD

The global financial crisis presents an opportunity for us to deepen our understanding of financial system dynamics and to reshape our thinking of macro prudential policy. After the crisis, we learned that financial stability is not only achieved by traditional monetary policy or micro prudential policy. It is now clear that the objective of macro prudential policy is to prevent the accumulation of financial systemic risks. In managing systemic risks, good policy design depends on a well informed analysis.

The objective of this study is to contribute to the set of macro prudential tools used in analysing systemic risk in the banking system. The framework aims to provide some indication of vulnerabilities in the banking system to prompt a detailed assessment of the risk. This project paper also has the potential to help policymakers address practical macro prudential policy questions. Is the capital of the banking system adequate to withstand shocks? What is the estimate of Type 1 and Type 2 errors in the assessment of systemic risk and thereby understand the price of action in the application of micro and macro prudential measures? What could be the price of inaction?

This collaborative research project was led by Mr. Eufrocinio M. Bernabe Jr., Project Leader and Visiting Research Economist of the The SEACEN Centre (OY 2011/12) and concurrently Bank Officer V at the Center for Monetary and Financial Policy, Bangko Sentral ng Pilipinas.

The SEACEN Centre wishes to express its sincere gratitude to the participating member central banks and their researchers for actively participating in this project and preparing the chapters of their respective economies. They are namely, Ms Hay Livine, Deputy Chief Division, Economic Research Department, National Bank of Cambodia; Ms Trinil Arimurti and Ms Gusti Agung Diah Utari, Economist and Associate Economist of the Directorate of Economic Research and Monetary Policy of Bank Indonesia respectively; Mr Kiwon Kim, Senior Economist, Financial Studies Team, Economic Research Institute, The Bank of Korea; Mr Win Hteik, Deputy Assistant Director, Secretary Department, Central Bank of Myanmar; Mr Suman Neupane, Assistant Director, Research Department, Nepal Rastra Bank; Mr Enrico R. Amat, Bank Officer V, Office of Supervisory Policy Department, Bangko Sentral ng Pilipinas; Dr C. Amarasekera, Senior Economist, Economic Research Department, Central Bank of Sri Lanka; and Ms Rebecca Fu-Ying Huang, Assistance Director General, Economic Research Department, Central Bank, Chinese Taipei.

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EXECUTIVE SUMMARY

The sources and the propagation of the financial crisis have proven the need for macro prudential policies to address systemic risk, as well as take into account the interplay between the financial system and the real economy. One important operational tool to characterise systemic risk is to model bank defaults. The results of the Contingent Claims Approach (CCA) model suggest that valuable indications of vulnerabilities can be derived from the use of individual balance sheet data of financial institutions. Also, the deterioration in financial markets and economy tend to increase bank's default probabilities.

The main aim of this project is to carry out systemic risk assessments in real time to support policy discussions. In this aspect, the CCA framework has proven useful in quantifying systemic risk on the banking sector. Ultimately, the results of the CCA framework could be used to assess the impact of banking sector vulnerabilities on the real economy. Most importantly, the CCA framework could be extended to serve as a building block of a broader macro prudential framework. The goal is to unify the results of the CCA framework with other quantitative models (i.e. network model) to sharpen risk assessment across the banking system. The idea is to integrate different sources of risk into a single model architecture that uses behavioural rules to model bank's behaviour that allows various feedback from banks. The single model architecture is envisioned to map out the topography of financial stability risk across the banking system.

In monetary policy context, inflation risk is mapped out in a "fan chart" (probability density function). The fan chart is based on a macro model which draws on a wide range of information. The macro model is a framework ensuring information is assembled and accounted for in a consistent manner. The ambition is to develop an equivalent model framework for aggregating and assessing financial stability risk for macro prudential purposes.

Chapter 1

FRAMEWORK FOR MACRO-PRUDENTIAL POLICIES FOR EMERGING ECONOMIES IN A GLOBALIZED ENVIRONMENT

INTEGRATIVE REPORT

By
Eufrocinio M. Bernabe, Jr.[1]

1. Introduction

The global financial crisis of 2008 has shown that a seemingly insignificant shock stemming from one financial institution can cause serious contagion and financial crises when amplified in the global financial system.[2] The lesson suggests the importance of a macro prudential policy that deals with measuring and containing systemic risk. This lesson prompts us to find and build additional diagnostic indicators to identify and measure in advance potential financial risk across the financial system and contain build up of systemic risk. This indicator has to capture the risk that evolves endogenously within the system, and to identify it at the build-up stage. In order for a systemic risk indicator to function effectively, we propose that it should satisfy several criteria. First, it should be able to signal warning of a build-up of systemic risk in advance. A financial authority may set thresholds to trigger warning signals. Second, the systemic risk indicator should be forward-looking with at least one year ahead of the real business cycle. Third, the indicator should be available in a timely manner to let financial authorities make timely decisions. It is believed that these criteria are satisfied by this collaborative research in the following manner: first, the proposed methodology would provide an indicator called the Distress Barrier (DBs) and Distance-To-Distress (DTD) to serve as the threshold and trigger signals respectively. Second, the methodology would be based on the option pricing model which theoretically and empirically has proven to incorporate forward looking expectations. Third, the methodology can be constructed on a

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2. The Financial Stability Board (FSB) later defined this kind of institutions as Global Systemically Important Financial Institutions (G-SIFIs) whose disorderly failure based on its size, complexity, systemic interconnectedness would cause significant disruption to the wider financial system and economic activity.

daily frequency since it will use financial market data such as stock and bond prices. The calibration of bank balance sheets and risk indicators is presented in Figure 1.

Figure 1
Calibration of Bank Balance Sheets and Risk Indicators
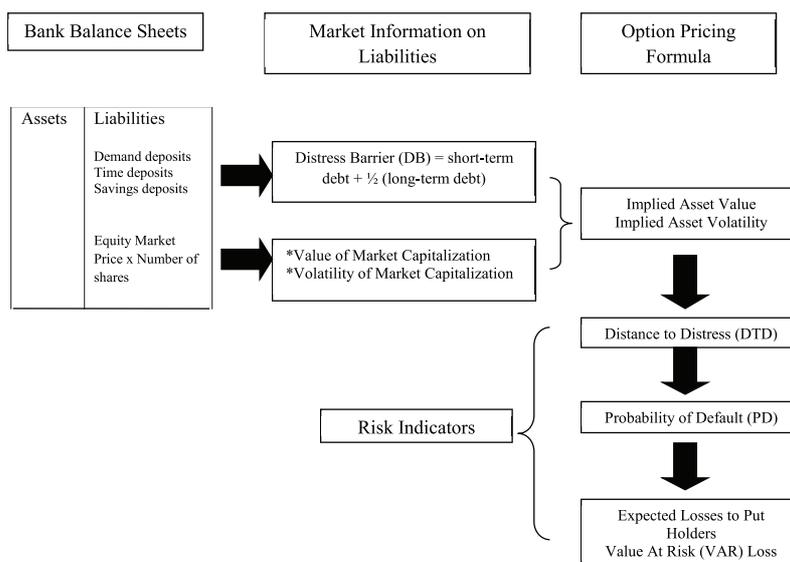
It is important to emphasise that macro-prudential policy is a key element of a broader framework of financial stability. While there are no specific guidelines and related literature prescribing a criteria for the design of a macro-prudential policy, it is observed that a macro-prudential framework has two pillars: the surveillance and monitoring of risks and the strengthening of the system's absorptive capacity to withstand risks. Policymakers broadly agree that the purpose of macro-prudential policy should be preventive in its orientation that is distinct from financial crisis management policy. Generally, macro-prudential policies can be categorised into three aspects namely: the analysis of financial system structure, the analysis of the financial system soundness and the robustness of financial system to shocks. Figure 2 describes the framework of financial stability analysis generally executed across the global and regional economies.

Figure 2
Framework of Financial Stability Analysis

Macro-Prudential Policies	Assessment of Observance of Standards and Codes	Review of Financial Sector Infrastructure and Governance Framework
• Analysis of financial system structure • Analysis of financial system soundness • Robustness of financial system to shocks	Peer Review	

1. Overall Assessment of Financial Stability
2. Formulation of Reforms
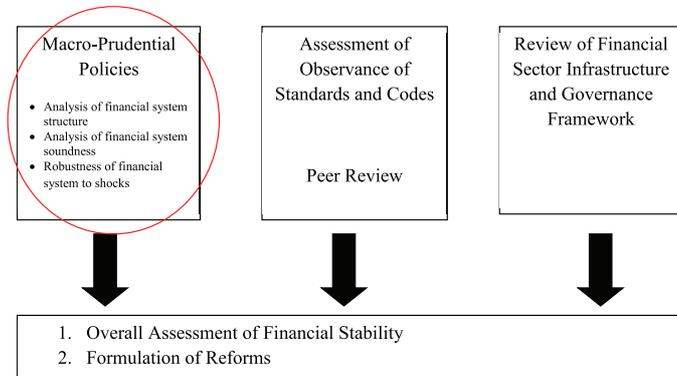
2. SEACEN Economies Experience in the Use of Macro-prudential Instruments

2.1 Instruments and Intervention

A survey among the SEACEN economies participating in the research, reveals that a number of them have used policy instruments to address aspects of systemic risks for quite some time. The macro-prudential instruments most commonly employed are reported in Box 1.

Box 1: Common Macro-prudential Instruments

Tools to address threats from excessive credit expansion in the system
  • Time varying capital requirements
  • Ceilings on credit
  • Caps on Loan-to-Value (LTV) ratio
  • Caps on debt-to-income (DTI) ratio
  • Reserve requirements

Tools to address key amplification mechanisms of systemic risk
  • Caps on foreign currency lending
  • Limits on net open currency position
  • Restrictions on foreign currency mismatch

Most of the instruments in use apply to banks. This reflects a focus by authorities on institutions that sit at the core of the SEACEN financial system and already subject to both micro-prudential regulation and supervision and liquidity management interventions by central banks. Some economies have used macro-prudential instruments to address financial stability risks associated with large capital flows even to the extent of introducing capital controls.

Most emerging Asian economies have a long experience with macro prudential tools than most advance countries.[3] According to Lyons et al. (2011), experiences from Asian economies have been quite successful in preventing valuation booms and credit bubbles. Lyons cited that Korea's caps on loan-to-deposit ratios and tightening of reserve requirement ratios in 2007-08 was accompanied by slowdown in private-sector credit growth. The author also claimed that similar outcomes were experienced by India and China in their respective implementation of measures curbing excessive credit growth.

In spite of these encouraging experiences by Asian economies, there are still issues and risks that must be considered. For instance, unlike macro prudential regulation, monetary policy has a clear, defined, measurable objective of price stability; and decision making is supported by extensive experience and academic research. Thus, better monitoring tools and analytical frameworks are needed so that regulators can identify emerging systemic risks.

To illustrate, financial authorities used historical balance sheet data (e.g., bank credit, maturity mismatches and currency risk) and macro data such as M1 to GDP, M2 to GDP and credit-to-GDP ratio as an indicator of systemic risk buildup in the banking system. These systemic indicators served as guide to financial authorities in setting macro prudential policies mentioned in Box 1.

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3. A BIS report counted 39 macro-prudential measures in the Emerging Market Economies (EMEs), but only eight in the advanced economies (see Table 3, page 10 in BIS-2010).

Figure 3
Credit to GDP and Real GDP Growth
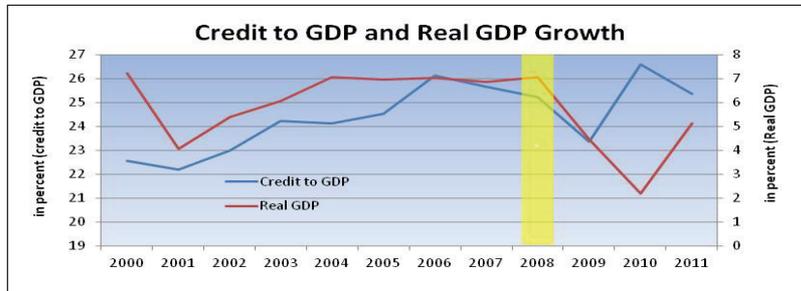
Data: Average aggregated data for all SEACEN Economies participating in the research computed by the author.
Data Source: Bloomberg.

Figure 3 shows that credit-to-GDP has some capability as a stress indicator. The ratio maintains its level before the 2008 crises and then drops during the crisis period. However, the credit-to-GDP has limitations.[4] For instance, the ratio did not identify potential risk but simply reflect the risk already revealed in the markets. Therefore, they fail to function as early warning signals. They only issue warning signals after the crisis has hit which means they can only be contemporaneous indicators. Making matters worse, data compiled for this statistics come with a significant lag which makes diagnostic analysis of the financial and economic situations belated. Drawing from this illustration, the available approaches currently being adopted by central banks may not be sufficient in assessing financial system soundness.

The focus of this research is on developing a more forward looking and real time macro-prudential measure to serve as a building block in analysing financial system soundness. Traditionally, financial fragility of financial institutions has focused on historical information such as non-performing loans, earnings and profitability, liquidity and capital adequacy ratios. However, given that balance sheet information is only available on a relatively low frequency basis and often with a significant lag, there have been growing efforts to measure the soundness of the financial system based on financial markets information. This market based measure is expected to provide a timely and continuous information since it will be available on every trading day. It is also forward looking since asset

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4. Philip Turner (2011) reported that the credit/GDP ratio was not a very good variable for EMEs. He argued that financial innovation and the rise of new industries mean that models based on past behaviour can be misleading, BIS Paper No. 62 (2011).

price movements reflect changes in market anticipation of future performance of the underlying securities. In turn, this allows changes in financial system risks to be identified as it occurs.

To construct the proposed macro-prudential measure, an option-pricing model will be employed to provide guidance on the determinants of risk and put forward the necessary structure to extract information from prices derived from equity markets. This paper uses Contingent Claims Approach (CCA) based on the option pricing model by Black and Scholes (1973) and Merton's (1977) extension of the Black-Scholes model. A contingent claim is any financial asset for which payoff depends on the value of another asset. The prototypical contingent claim is an option - the right to buy or sell the underlying asset at a specified exercise price by a certain expiration date.

3. Literature Review

Altman (1968) and Ohlson (1980) used balance sheet data to derive probability of default metrics. For instance, the Altman's Z-score is a linear discriminant model where borrowers are classified into either high or low default risk categories. Although the framework does not directly give a probability of default, the results can be mapped to a credit rating system which would in turn yield the desired estimates. Similar to Altman, Ohlson uses linear discriminant analysis to derive the probability of default of a firm. The framework utilised the maximum likelihood techniques to estimate a logit model of probability of default of various firms.

There are reasons an accounting based method may be weak in estimating probability of default. While a probability estimate are statements about future events, financial statements are designed to measure past performance, and thus may be less informative about the future status of the firm. Also, financial statements are formulated under the going-concern principle which limits the assessment of default. The conservatism principle used in preparing financial statements often causes asset values to be understated relative to their market values. This is particularly true for fixed assets. The downward biased asset valuations will cause accounting based leverage measures to be overstated. These aspects of the accounting system will limit the performance of any accounting based insolvency measure. Another important limitation of accounting based measure is that it does not take into account asset volatility. Volatility is a crucial variable in default analysis because it is a key component in computing the likelihood that an entity will unable to repay its debt within a specific time horizon. All things being equal, the probability of default is increasing with volatility

and therefore two firms with identical financial ratios can have substantially different credit risk depending on their asset volatilities (Hillegeist, et al. 2003).

In contrast to the balance sheet approach, the Merton Model is a structural model. The probability of default of a firm is captured as an endogenous process and is a measure of the likelihood that a firm's assets in the future are likely to fall below its liabilities. The Merton Model and the CCA is based on three principles: (i) the value of liabilities flows from assets; (ii) liabilities have different seniority; and (iii) there is a random element in the way an asset's value evolves over time.

The main advantage of the CCA/Merton Model is that it uses observable balance sheet and financial market data along with volatility to construct a measure of default risk. The ability to translate continuously adjusting financial market price information into current market value estimates is important given the speed with which economic conditions change relative to the time span between releases of balance sheet information. Furthermore, the CCA combines the capital structure of the balance sheet with current market price information from financial markets to construct a market value estimate of the current balance sheet along with forward looking indicators of vulnerability. In addition, the CCA distinguishes itself from other vulnerability analysis by recognising the important role of volatility in determining default probabilities. By capturing volatility, the CCA accounts for the fact that entities with the same capital structures may have different Distance-to-Distress (DTD) and Probabilities of Default (PD). The CCA methodology also incorporates nonlinearities which yield significant improvements over traditional linear relationships in vulnerability analysis. In option pricing theory, the value of the option is dependent on changes in the underlying asset. The nonlinearity of the Black-Scholes-Merton methodology allows for more accurate description of changes in vulnerabilities arising from large changes in asset prices. On the other hand, linear relationship is limited as it may understate the evolution of risk over time as result of exogenous shocks.

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4. Methodology: Framework for Assessing Systemic Risk of Financial Institutions

4.1 Theoretical Concept

The Contingent Claims Approach is a structural model based on the Black-Scholes and Merton Model. Consider a case of firm with assets, V, which are financed by debt obligation, F, and Equity, E. The historical value of the firm's assets is simply the sum of the firm's debt and equity:

$$V_t = F_t + E_t \tag{1}$$

The value of the firm's debt obligation is also known as the distress barrier, DB. The probability of default ($V_{t+1} < F_{t+1}$ or DB) exist as long as it is greater than zero. This implies that at time t+1, the market value of assets, B_t, is lower than the yield to maturity of the debt, Fe^{-rT}, where r is the discount rate used to arrive at the present value of debt. In this simplified firm structure, the risk is a function of the leverage ratio, $LR = Fe^{-rT}/B_t$, the volatility of the rate of return of the firm's assets, o_v, and the time to maturity of the debt, T. Thus, for a creditor who extended a loan to this firm must purchase a put option to eliminate the risk on the loan[5]. The value of the put option, P_o, on the market value of the firm assets, B_t, for the term of the debt must have a strike price, S, equal to the face value of the loan. The creditor can completely eliminate the credit risk and convert the risky loan into a riskless loan. If the riskless interest rate is r, then in equilibrium it should be that:

$$B_t + P_o = Fe^{-rT} \tag{2}$$

In applying the Black-Scholes and Merton model, the value of the put can be written as:

$$P_o = -N(d_1)\ B_t + Fe^{-rT} -N(-d_2) \tag{3}$$

where P_o, is the current value of the put, N(.) is the cumulative standard normal distribution, B_t is the market value of assets, and Fe^{-rT} is the present value of debt.

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5. A put option is a contract between two parties to exchange assets for an agreed amount (strike price) at a specified future date. The buyer of the put, has the right but not the obligation to sell the asset at the strike price. The seller has the obligation to buy the asset once the buyer exercises his right.

To derive d_1 and d_2 we make the following transformation presented in equation 4 and 5,

$$d_1 = \frac{\ln(\frac{B_t}{F}) + \left(\mu + \frac{1}{2}\sigma^2\right)T}{\sigma_v\sqrt{T}} = \frac{\ln(\frac{B_t}{Fe^{-rT}}) + \left(\mu + \frac{1}{2}\sigma^2\right)T}{\sigma_v\sqrt{T}} \qquad (4)$$

$$d_2 = d_1 - \sigma_v\sqrt{T} \qquad (5)$$

where μ is the expected return on the assets, and σ_v is the standard deviation of the rate of return of the firm's assets. The numerator measures the distance between the expected one-year ahead market value of the firm's assets and the distress barrier. The denominator is used to scale the numerator with respect to units of standard deviations. Thus, the probability of Default, ($V_{t+1} < F_{t+1}$ or DB) is as follows:

$$(6)$$

$$\text{Probability of default} = N\left(-\frac{\ln\frac{V_0}{DB} + (\mu - \frac{\sigma_v^2}{2})T}{\sigma_v\sqrt{T}}\right)$$

$$(7)$$

Using equation (5), the expected return on assets, μ, can be computed as follows:

$$\mu = \max\left[\frac{V_{t+1} - V_t}{V_t}, r\right] \qquad (8)$$

where r, is the one year Treasury Bill rate and T, is set to one year so that the probability emerging out of the assessment is the one year ahead probability of default on an *ex ante* basis.

Moreover, the equity of the firm, E_t, is itself a contingent claim on the firm's assets. Since equity holders have a subordinated claim on the residual value of the assets, the value of the equity can be viewed as a call option. This means that equity holders receive the maximum of market value assets minus the default barrier or nothing in case of default. Given that the firm's equity behaves like a European call option[6] on the firm's assets, the Black-Scholes and Merton

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6. European call option an option for the right to buy a stock or an index at a certain price on a certain date prior to expiration date. This differs from the "American style call option" which can be exercised at any date prior to expiration.

model can be used to compute the equity value. The equation for valuing equity as a European call option is:

$$E_t = V_t N (d_1) - Fe^{-rT} N(d_2) \tag{9}$$

4.2 Estimating Financial Institution Risk Using the Contingent Claims Approach

In the theoretical concept, it is shown that the Black-Scholes and Merton Model can be applied to calculate risks in the financial system by showing the distance of institutions from the distress barrier and estimate the probability the default. In cases where the debt and equity are both traded, the market value of assets, V, can be reconstructed by adding the market values of both debt and equity as stated in equation (1). However, practical problem arises in cases where firm debt is not traded and only equity is traded or vice versa. For this project, the data on the Top Big Banks are limited only to institutions where there are available equity prices. Since most of the participating economies are constrained by market data availability of debt, the distress barrier (Fe^{-rT}) is determined as a function of the short-term debt and long-term liabilities of the firm.[7] Thus, the transformation of historical balance sheets of banks to market value terms using CCA employs the hybrid of both the Black-Scholes-Merton Model and Vasicek and Kealhofer Empirical Model.

According to the Vasicek (1968) and Kealhofer (2000) Empirical Models, firms default when the asset value reaches a level that is somewhere between the value of the total liabilities and the value of the short-term debt. Therefore, the tail of the distribution of asset values below the total debt may not be as accurate as a measure of actual probability of default. The loss of accuracy may result from the non-normality of the asset return distribution or the firm is able to draw on lines of credit (unobservable). Thus, the default barrier is computed as the sum of short-term debt plus half of the long-term debt. Figure 4 describes Vasicek and Kealhofer empirical model.

For the market value of equity, E_t, it is equal to the number of outstanding stocks multiplied by the closing stock price as of the balance sheet date. To calculate a single systemic risk indicator, an aggregation technique based on the weighted average market value of assets is used.

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7. Crouhy, Michel et al., (2001), "Risk Management", pages 371 to 374, First Edition.

Figure 4
Vasicek and Kealhofer Model
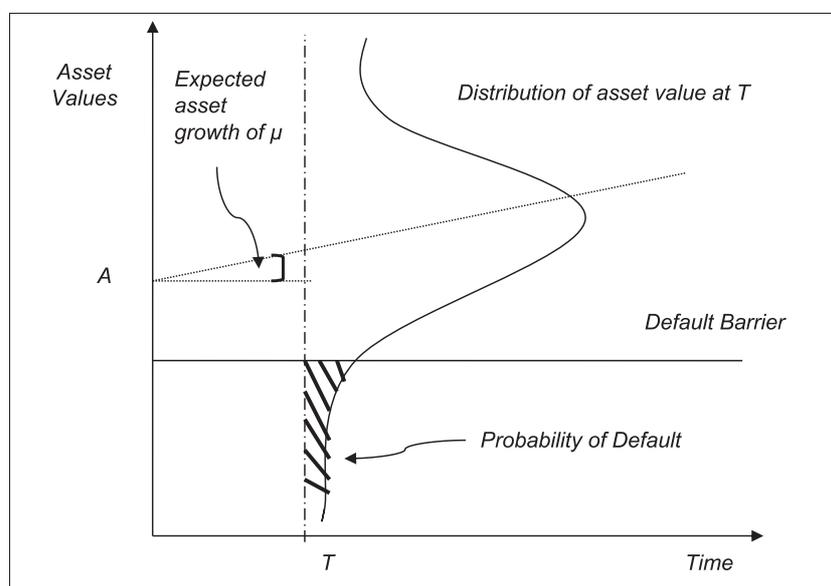
5. Empirical Results

5.1 Assessing Risk to the Banking System Using the Contingent Claims Approach (CCA)

Using time series data of market capitalization and liabilities of the Top 10 banks in their respective economies, each SEACEN researcher applied the CCA to produced a useful banking risk indicator such as Distance-to-Distress (DTD). The common result suggests that the highest-risk period was in the year 2008 during which negative news in the global markets started to emerge.[8] The CCA can also produce the risk-neutral Probability of Default (PD) for each of the Top 10 banks in the SEACEN economies. The overall PDs for most of the SEACEN economies peaked around the time of the 2008 global financial crisis.[9]

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8. March 2008 is the period of the news announcement of Bear Sterns takeover by JP Morgan Chase. September 2008 is the period when Lehman Brothers declared bankruptcy.

9. Based on observations from researchers output, the interpretation of estimates of the level of probability of default should be treated with caution since estimates for some economies pertain to only a relatively short sample period. Among eight (8) SEACEN economies that participated in the research, only four (4) actually applied the CCA methodology namely Indonesia, Nepal, Philippines and Sri Lanka.

For this empirical experiment, monitoring banking risk through the CCA model is a useful tool for policymakers but relating the banking risk to the effect of changes in the macroeconomic environment and individual bank ratios provides a more important insight. The Vector Auto Regression (VAR) analysis is employed to provide evidence on how the CCA produced indicator respond to macroeconomic variables of each economy. In the VAR analysis performed by most researchers, the PDs are negatively and significantly affected by the return in the stock market index and Gross Domestic Product (GDP) growth. This suggests that the deterioration in the financial markets and economy as a whole increases the defaults of entities. As expected, leverage and non-performing loans have a positive and significant effect on PDs. So in general, the PDs allow a strong feedback effect from the banking system to the macro economy and the general financial market.

It is noteworthy that an advantage of using VAR is that many factors that need to be modeled separately by other estimation process – including international spillovers and the role of monetary policy, are implicitly incorporated. However, since statistical relationships are estimated from historical data, they may not be fully informative about how economic actors will respond to future policy changes (the Lucas critique).

From the VAR analysis, researchers derive impulse-response functions that are used to show how a shock to macroeconomic factors and bank ratios impacts the assets of each of the banks. Generally, the persistence of shocks to banks is quite large. A shock to non-performing loans (NPLs) and total deposits causes a strong impulse response on PDs. In effect, the results support the VAR findings that a deterioration in NPLs and decline in deposits cause a rise in PDs.

The results of VAR and Stress test analysis highlighted a number of considerations one should keep in mind when interpreting the CCA output. First, individual bank default probability estimates are sensitive to estimates of the volatility of the asset/liability ratio which, in turn, are sensitive to estimates of the volatility of bank equity. This means that if a bank's equity market volatility had been unusually high (low) relative to equilibrium, the probability of default would be biased upwards (downwards). More importantly, if equity market volatility during the sample period is excessive relative to the volatility implied by economic fundamentals - there is "excess volatility" - then all estimates of probability of default will be biased upwards. Second is the issue on measurement error. The data inputs are market capitalisation and bank liabilities. Whereas the former are forward-looking and reflect the market's assessment

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of expected profits, the latter are backward-looking and are based on historical cost accounting. To the extent that historical cost accounting does not capture the fair value of liabilities, this will result in inaccuracies of default probability estimates. Finally, option-based approach is built on the assumption that publicly available information incorporate future prospect of insolvency into prices. However, some studies suggest that the market does not always reflect all the information in prices (the inefficient market hypothesis).

6. Policy Implications

Based on empirical results, the CCA banking risk framework provided some indication of vulnerabilities prior to financial market volatilities which underscored the framework's ability to act as an early warning indicator. For risk surveillance purposes, the so called signaling approach would be the best way to use the CCA banking risk indicator. In this manner, the CCA framework should be interpreted and assessed relative to the default threshold value. If the distance to the threshold is breached or close to be breached, this sets the warning light flashing. This serves not as a signal of an impending crisis but instead as a prompt for a detailed assessment of that particular risk.

The CCA methodology offers policymakers a forward looking and high frequency indicator of vulnerability but it is highly dependent on available daily asset prices. Thus, economies for which financial markets are less developed will have to rely on actuarial or reduced form approaches of measuring risk and vulnerabilities.

7. Areas of Further Research

Furthermore, the strength of the CCA framework is its capability to be integrated into a broader macro-prudential architecture. The goal is to unify the results of the CCA framework with other quantitative models (i.e. network model) to sharpen risk assessment across the banking system. The idea is to integrate different sources of risk into a single model architecture that uses behavioural rules to model bank's behaviour that allows various feedbacks across banks. The single model architecture is envisioned to map out the topography of risk across the banking system. This is an area of future extension of this research study. The modular construction of the macro-prudential architecture is shown in Figure 5.

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Figure 5
Macro-prudential Architecture

Risk Factors

Shock Scenarios

Feedback on bank's
balance sheet

Asset-side risk
Liability-side risk

Network model of Banks

Credit, market and
income risk

Understand fundamental and contagion events
Value at Risk for Central Bank
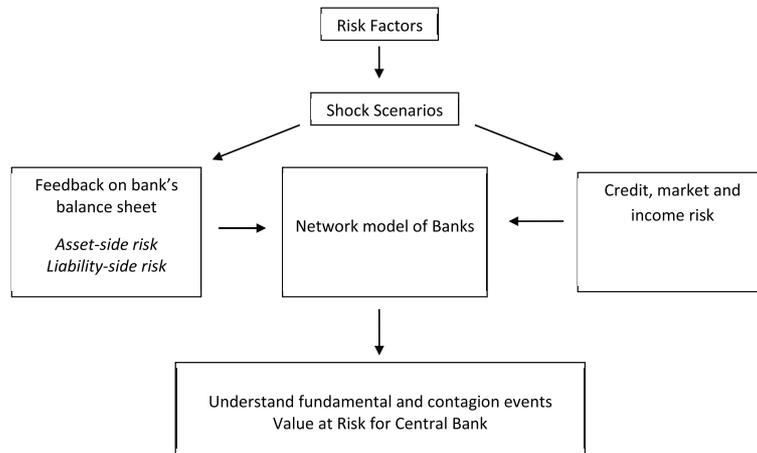
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Chapter 2

A MACRO-PRUDENTIAL ASSESSMENT FOR CAMBODIA

By
Hay Livine[1]

1. Introduction

In any economy, banks play an important and sensitive role. Their performance directly affects the growth, efficiency and stability of the economy. Given the recognised importance of economic growth to poverty reduction, economic losses ultimately result in setbacks to poverty reduction and other developmental targets. Consequently, in recent years, the international community has highlighted the need to strengthen safeguards against financial instability. One such safeguard is strengthening and calibrating the macro-prudential orientation of monitoring financial soundness and regulating and supervising financial institutions.

Macro-prudential can be defined as policy that focuses on the financial system as a whole, and also treats aggregate risk as endogenous with regard to collective behaviour of institutions. It aims to limit system wide distress so as to avoid output costs associated with financial instability (Borio, 2009). Owing to the costs of crisis, it has been realised that there is an immense premium on timely warnings regarding systemic risks as an input to policy decisions as well as to strategies and market behaviour of financial institutions. Accordingly, in the last decade 'macro-prudential surveillance' defined as monitoring of conjuncture and structural trends in financial markets so as to give warning of the approach of financial instability has become a core activity for many central banks.

In Cambodia's highly dollarised economy, fiscal policy plays a predominant role in macroeconomic management. Cambodia witnessed a period of high inflation during 1995-1998, reaching 14.7% in 1998 as a result of monetary

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financing of the budget deficit. The implementation of fiscal discipline by way of rationalising expenditure, mobilising revenue and stopping the practice of central bank financing of the budget deficit, helped Cambodia keep inflation at a low level up to 2004. Cambodia has continued to pursue a conservative fiscal policy stance aimed at avoiding the monetisation of the budget deficit and limiting external borrowings to infrastructure investment requirements. As a consequence, public external debt and debt service burden are low and manageable. Monetary policy, on the other hand, aims at maintaining price stability. The National Bank of Cambodia (NBC) envisages inflation at less than 5% in the near term and at about 3.5% over the medium term. In Cambodia's small, open, dollarised economy, the foreign exchange market is shallow. Near total dependence on imports for most consumer goods and petroleum products makes Cambodia vulnerable to external shocks. Under the current monetary regime, fluctuations of the exchange rate and commodity prices in the world market have an immediate impact on the domestic economy.

The global economic crisis at the same time stimulated the necessity of enhancing higher standard of prudential regulation in order to deal with emerging banking operations and to maintain financial stability. From a macro-prudential view, focus should be placed on the major sectors and institutions of the financial system. Banking institutions are particularly relevant because of their specific function as suppliers of liquidity to the system and because the impact of financial stress on these institutions can have significant macroeconomic costs. Thus, the NBC undertook a revision of the supervisory framework and prudential regulation to cope with a number of potential risks that have emerged through the rapid expansion of banking and financial operations in Cambodia. Besides its primary role of maintaining macroeconomic and financial stability, the NBC also committed to keep in line with international practices and guidelines.

The performance of the banking sector appears to be quite promising in the years ahead. Developing the financial market infrastructure is one of the agenda of the NBC. It is currently focusing its efforts in establishing the money and interbank market, launching a credit bureau, and also enhancing government practices within banking institutions. Together with this, the NBC issued some prudential regulations,specifically: Prakas on Net Worth Calculation, Prakas on internal control, and Prakas on risk-based and forward-looking supervision. These recent regulations will further enhance the banking and financial institutions for them to be safer and stronger.

This paper presents a framework for macro-prudential policies of Cambodia and evaluates the issues and challenges faced by the financial institutions. Also, the paper provides an overview of the recent developments of the financial institutions in Cambodia.

The paper is divided into seven sections. Section 1 provides a general description of macro-prudential framework in Cambodia as an introduction. Section 2 discusses the key prudential indicators. Section 3 presents the methodology for assessing systemic risk of major financial institutions. Section 4 reviews some data on financial statements and domestic micro and macro-financial conditions. Section 5 describes the policy recommendations. Finally, concluding remarks would be specified in Section 6. The research for this paper is based on secondary data since primary data is not exist.

2.   Elements of Macro-prudential Policy Framework

The high growth performance of the Cambodian economy presents an opportunity for modernising the financial system, diversifying financial markets and enhancing capacity for the mobilization of new resources for development. However, to enhance the capacity to withstand external shocks and to manage an increasingly sophisticated financial system, financial regulation and supervision should be improved. Regular surveillance of the financial condition of the government, and of financial and non-financial sectors is imperative to better understand how the key entities are managing risks; identify sector-wide or systemic vulnerabilities; determine the dimensions of those vulnerabilities; assess regulatory and supervisiory structures and prepare the appropriate responses. The Financial Sector Development Strategy (FSDS), 2011–2020, is an update of FSDS 2006-2015 and has been prepared in the context of an economy that has experienced a long period of high growth and is recovering from the spillover effects of the global financial crisis.

Discussions were made by NBC management to establish a Financial Stability Unit within the central bank. Pursuant to the technical assistance recommendation of the IMF, NBC established a financial stability team in May 2011. The team is undergoing training with the purpose of identifying serious threats or potential risk propagation channels across the financial sector and the banking system and drawing banking supervisiors' attention to such risks. In addition, the team acts as an essential complement and support for the implementation of risk- based and forward-looking supervision.

2.1 Macro-prudential Policy Objectives

For Cambodia, the objective of macro-prudential policy is to examine trends in financial system that can impact financial stability (banking system). Financial stability cannot be achieved through prudential policies and market discipline alone. It requires contributions from monetary and fiscal policies as well. Monetary policy should be focused on controlling inflation, while fiscal policy is responsible for countercyclical demand management. Critics may argue that it is not possible to achieve the two objectives with a single instrument.

Cambodia has adopted the Financial Sector Development Strategy (FSDS), 2011–2020, for long-term financial sector development about ten years ago. The government was conscious that an economy will not reach its growth potential and develop at an adequate pace without active contribution from the financial sector. The Cambodian government is committed to strengthening the financial system and, over the recent years, has been enacting legislation, adopting policies, creating institutions and adapting procedures as part of the financial sector reforms in order to accelerate the pace of economic growth.

2.2   Instruments and Intervention

As Cambodia is a small and open economy, the NBC acknowledges the need to build sufficient infrastructure to support the development of the financial sector, including development of the payment system, money and interbank market, establishment of a credit bureau, strengthening of governance practices, and improvement of other areas. In this regard, the NBC issued some prudential regulations as tools for guiding and maintaining financial stability for the entire banking system such as: Prakas on Net Worth Calculation, which has been revised following international standard. This revision on Net Worth Calculation has made the definition of the balance of each item more clear to ensure more control in the unanticipated flow of a particular item. In addition, Prakas on Internal Control is a means to facilitate the governance of financial and banking institutions and is purposed to: (1) support management in the exercise of its responsibilities; (2) allow for early identification, assessment and management of risk; and (3) support risk awareness and responsiveness in the implementing of corrective actions. Additional to the abovementioned Prakas, Prakas on Risk-Based and Forward-Looking Supervision was issued in response to the requirement of the Basel Core Principles on Effective Banking Supervision. This approach allows supervisors to anticipate potential adverse developments and address them in a timely manner. Additionally, by implementing risk profile assessments, supervisors are able to focus on major issues and allocate available

resources more effectively. These recent regulations will further enhance the banking and financial institutions to be safer and stronger.

3. Key Prudential Indicators

3.1 Assets Quality

Non-performing loans in the banking sector was almost 3% in 2010, 5% and 3.6% in 2009 and 2008, respectively. NPL increased in 2009 was partly the result of two factors. The first and foremost explanation is the impact of the global financial crisis. Prominent sectors of the economy such as textiles, tourism, construction and agriculture were adversely affected by the crisis. Firms and businesses related to these industries also saw a decline in demand and consumption. Consequently, banks experienced repayment difficulties in their credit financing. Another explanation is the introduction of a new guideline on credit classification at the beginning of 2009, which imposed more stringent criteria for recognising problem assets. This new guideline was fully adopted in 2009 and resulted in higher classified assets.

The distribution of credit by economic sector reveals that, as of the end of 2009, the largest concentration of credit was recorded in retail trade activities (18% of the total portfolio), followed by wholesale trade and the hotel and the restaurant industry. Retail and wholesale trade, which comprise mainly small to medium enterprises, form the backbone of private businesses in Cambodia. funds channel to these sectors, the more job creation and promotion of household income level. Construction and real estate together accounted for 15% of the total portfolio. These sector are considered high risk sectors, and funding to these sectors is projected to face some repayment difficulty. Credit concentration in other sectors was recorded at manageable levels.

Figure 1

Credit concentraltion by sector
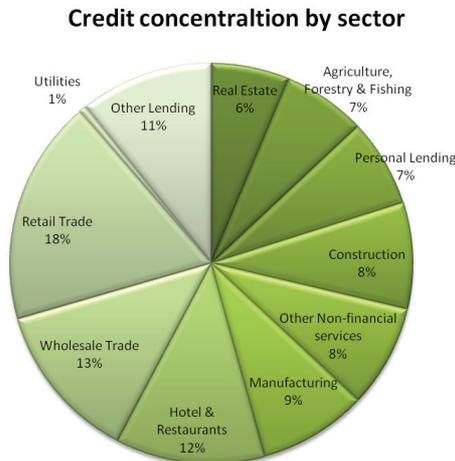
3.2 Profitability

Banks' profitability saw a significant reduction since the onset of the global financial crisis. Return on equity declined significantly from the peak of 16.6% in 2007 to only 6.6% in 2010. Similarly, return on assets dropped by more than half, from 2.9% in 2008 to 1.4% in 2010. Some factors were attributed as the main causes of this reduction, namely the slowdown of credit expansion, the slight growth of non-performing loans, the additional cost of accumulating customer deposits and the rapid expansion in branch networks. In 2009, 22 bank branches were opened while there were 28 branches in 2010. Most banks shifted toward fee- and commission- based income in order to reduce credit risk exposures and minimise funding costs.

Figure 2

Banks-Return on Equity & Return on Assets

(Return on Equity) 2005: 7.9%, 2006: 14.2%, 2007: 16.6%, 2008: 13.1%, 2009: 5.6%, 2010: 6.6%

(Return on Assets) 2005: 1.8%, 2006: 2.8%, 2007: 2.8%, 2008: 2.9%, 2009: 1.3%, 2010: 1.4%
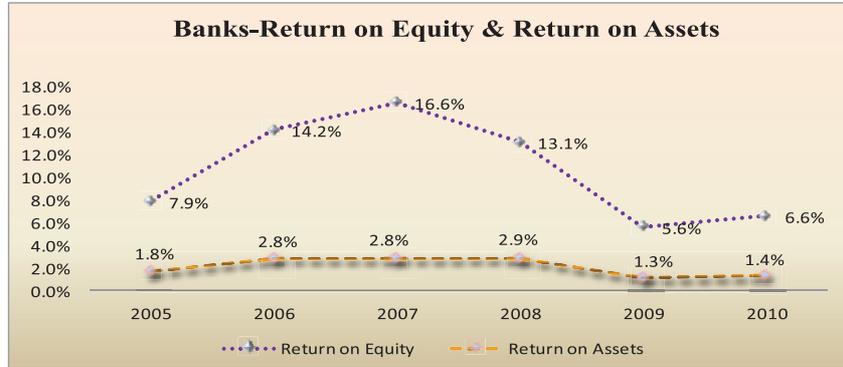
3.3 Liquidity

Over the previous five years, the liquidity ratio of the banking system trended downward to the lowest point of 81% in 2008, as compared to the prudential limit of 50%. For the first time, the ratio bounced upward to 90% by the end of 2009 and reach 91% in 2010. The growth of credit disbursement lagged behind the growth of deposits, allowing more liquid assets to join the assets mix, thus stimulating the rise of the liquidity ratio. As the result, liquidity in the banking sector is of less concern since it possesses high liquidity cushion and builds up overtime.

Figure 3
Liquidity Ratio

(Liquidity Ratio) 2005: 118%, 2006: 108%, 2007: 104%, 2008: 81%, 2009: 90%, 2010: 91%

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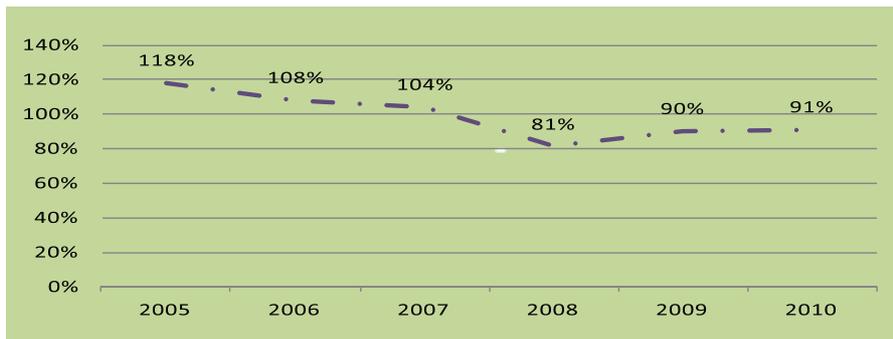
4. Data

4.1 Financial Statements & Time Series Data of Commercial Banks

Figure 4
Statement of Condition

As at December 31 *(billions of KHR)*

	Total Assets	Cash, Loans, Deposit with NBC and Banks					Loans & Advances to Customers			Securities	Claims on government	Prepaid Expenses	Fixed Assets	Other Assets
		Cash	Gold	Deposit with NBC	Due from Banks	Deposits with, Loans & advances to, Bank	Loans & advances to state enterprises	Loans & Advances to private sector	Accrued interest receivable					
2006	**7,580**	527	1	1,816	683	808	2	3,331	34	-	8	55	286	29
2007	**13,270**	792	1	3,073	1,110	1,651	1	6,095	28	-	-	83	367	68
2008	**16,797**	1,080	0	3,882	522	1,001	0	9,501	58	1	-	105	577	69
2009	**20,549**	1,267	0	5,944	1,056	1,375	-	9,946	61	1	-	89	720	88
2010	**25,547**	1,612	28	7,273	1,216	1,574	2	12,623	83	52		113	774	199

Figure 5
Statement of Condition

As at December 31 *(billions of KHR)*

	Total Liabilities & Equity	Owed to NBC	Owed to Banks	Borrowed Funds	Customer's deposit					Other Liabilities	Shareholder's equity				
					Demand deposits	Saving deposits	Fixed deposits	Accrued interest payable	Other deposits		Paid up Capital	Reserves	Subordinated loans (after NBC's agreement)	General provisions & other	Retained & Current Profit/Loss
2006	**7,580**	24	56	230	1,445	2,316	1,838	-	85	139	1,048	2	89	43	265
2007	**13,270**	40	808	174	2,374	4,650	2,786	-	109	176	1,413	13	97	44	587
2008	**16,797**	40	2,402	209	2,445	3,666	4,060	56	56	279	2,288	13	236	71	977
2009	**20,549**	-	1,721	211	2,786	4,499	6,389	101	61	339	2,975	13	217	133	1,104
2010	**25,547**	-	1,767	183	3,345	6,269	7,648	126	86	598	4,087	11	211	143	1,073

Figure 6
Profit and Loss Statement

Ended December 31 *(billions of KHR)*

	Interest Income	Interest Expenses	Net Interest Income	Non Interest Income	GDP (Gross Opertaing Inc or Loss)	Operating Expenses (excluding depreciation)	Provision Expenses		Recoveries	P&L Before Tax	Profit tax	Extra gains or Losses Prior year Adjustment G/Reserves	Net Profit & Loss for 12 months
							Depreciation	Bad Debts & Doubtful					
	1	2	3=1-2	4	5=3+4	6	7	8	9	10=5-6-7-8+9	11	12	13=10-11+/-12
2006	473	99	374	128	502	220	20	66	42	238	20	0	218
2007	726	172	555	191	746	319	27	106	113	408	46	12	374
2008	1,185	318	867	271	1,138	494	122	-	42	564	78	1	487
2009	1,322	487	835	270	1,105	603	66	203	68	302	54	9	256
2010	1,436	458	978	316	1,294	648	82	137	30	458	91	(1)	366

4.2 Domestic Micro and Macro-financial Conditions

4.2.1 Total Capital

By the end of 2010, the solvency ratio of the banking system had reduced slightly to 31.3% though total net worth increased by 26%, most of which was due to the recapitalization to meet the new minimum capital requirement. Total Tier I capital remained, sharing the large part of the net worth (99%), which represented highly stable capital base. Only few banks had Tier II capital composition. In near term, the total net worth in the banking system is expected to rise due to the inclusion of income generation during the year. Return on assets and return on equity for banks improved to 1.4% and 6.6%, respectively. Such improvement was strongly contributed by good asset quality where lower provisioning expense was required. Reduction of overhead expense and tax in relation to total assets also helped to promote earning growth. Overall, capital position in the banking system remains strong, which allows more room for absorption of loss. However, rapid credit expansion remains to be closely monitored.

Figure 7
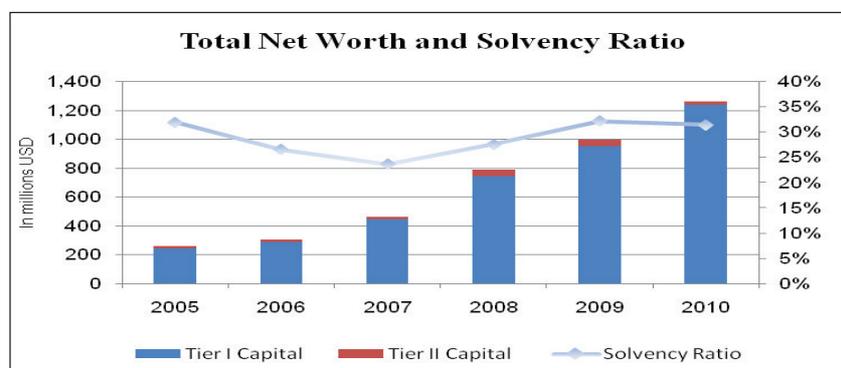
4.2.2 Non-performing Loans

The non-performing loan (NPL) ratio shrank to 3% in 2010 from about 5% in 2009, while specific provisioning for NPL declined from 60% to 55% in 2009 and 2010, respectively. Net NPL after deduction of provisioning recorded at 1.37% by the end of 2010. Related party lending rose slightly but still within the

prudential limit of 10%. As at the end of 2010, related party loans ranged from the highest of 6.73% to the lowest of 0.04% of the net worth. Large exposure lending jumped to almost 70% of the total portfolios. The government recently has put in effort to channel more credit to the agricultural sector through the Credit Guarantee Scheme. Overall, the adoption of the new regulation on credit classification in line with international best practices enhanced the credit quality of the banking institutions as the regulation provides comprehensive guideline for ecognizing non-performing assets and at the same time banks proved to be more proactive in mitigating credit risk.

Figure 8
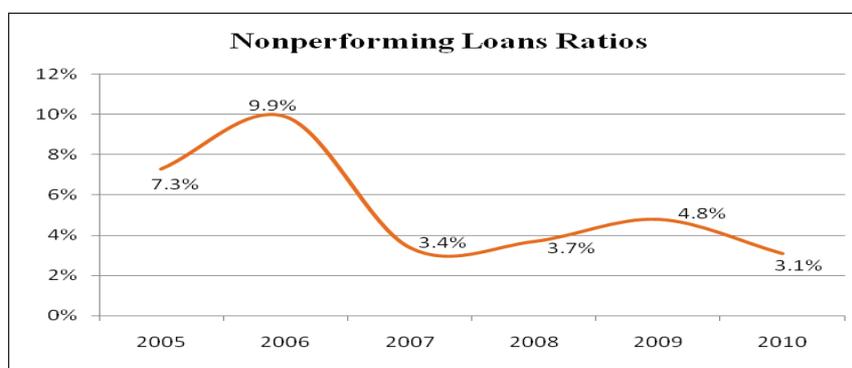
4.2.3 Total Deposits

The performance of the banking sector improved substantially over the last five years. Intermediation in term of deposits and credits also progressed significantly sharing 37% and 28% of the GDP by year end 2010. During the boom period shortly before the global financial crisis, deposit growth in the banking sector recorded its peak at 76% in 2007 while during the bust period grew only by 3% in 2009. The number of depositors has been increasing steadily even during the period of the economic slowdown which demonstrates strong public confidence in the banking sector.

Figure 9

Deposits & Loans in Banking System to GDP

Figure 10

Growth Rate of Credits & Deposits
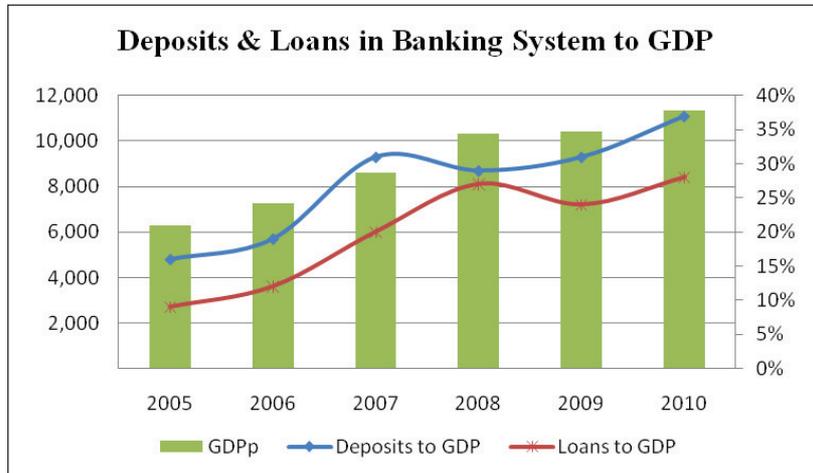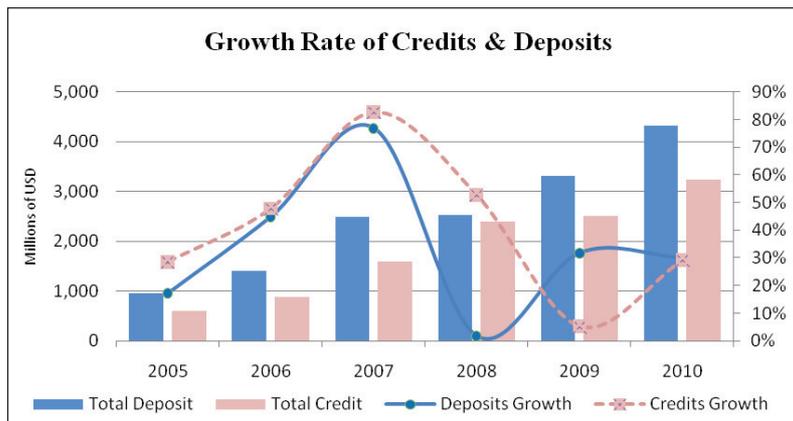
4.2.4 Stock Market Index

The lack of organised stock exchange and commodity exchange market hindered banking institutions from investing in these markets. Thus, the risk involving equity price risk and commodity price risk is almost absent.

4.2.5 Inflation

As the global economy is facing high unemployment and high inflation, Cambodia, a small country with open economy, is obviously unable to escape from these impacts. The shallow foreign exchange market and overt dependence on the imports of most consumer and petroleum products render Cambodia vulnerable to external shocks. Fluctuations of the exchange rate and price in the world market will immediately pass through to the domestic economy. As a result, Cambodia raised its inflation rate forecast to 5.5% (average) for the year 2011, up from its earlier prediction of the maximum of 5%.

The soaring price of petroleum is the main cause fueling the high rise of the inflation rate in Cambodia. Since the start of the year, the price of gasoline increased by 10.6% to US$1.38 a liter in June, up from US$1.25 in January, 2011.

Figure 11
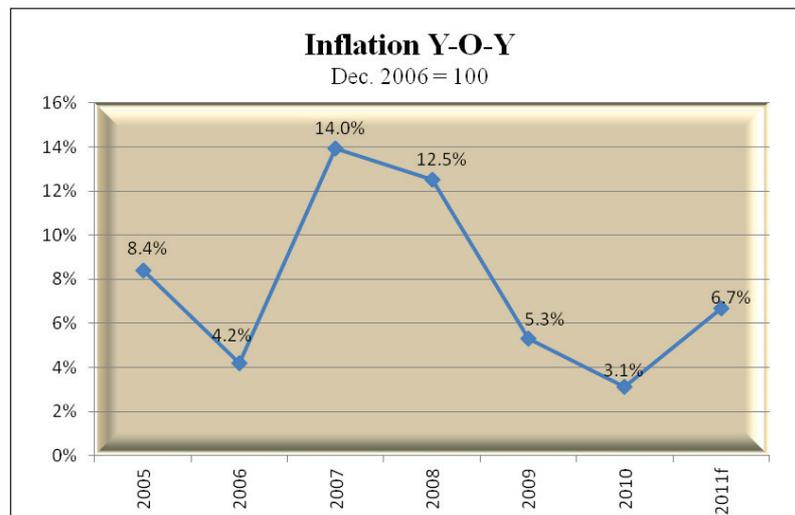
4.2.6 GDP Growth Rate

Cambodia's GDP per capita has improved during the last few years. However, it is still relatively low when compared with other countries in the region. The main sectors of the economy are garment, construction, agriculture, and tourism. The garment industry contributes more than 70% of Cambodia's exports.

Recently, oil deposits were discovered in territorial waters, which along with bauxite, gold, iron and gems mining may provide resources for future development.

The value of Cambodia's garment exports to the United States in the first six months of the year 2010 compared to the same period last year increased by over 23%. Meanwhile, tourism arrivals increased by more than 13% and rice exports are on an upward trend. Cambodia will maintain solid economic growth for 2010 given the faster than expected recovery of garment exports and tourism as well as the positive outlook for the expansion of agricultural products. However, the current slowdown in global trade is likely to temper growth momentum in 2011and 2012.

Nevertheless, the declining trend in global markets is not expected to outweigh the positive growth already perceived. However, long standing challenges remain for Cambodia's narrowly based economy – accelerating economic diversification, expanding the fiscal space, addressing governance issues, and strengthening the investment climate.

Cambodia needs to address the long standing challenges to achieve sustainable growth. Reducing the high cost of transport, energy and diversifying agricultural products and the tourism sector are critical and will be addressed under ADB's Country Partnership Strategy, 2011-2013.

Figure 12

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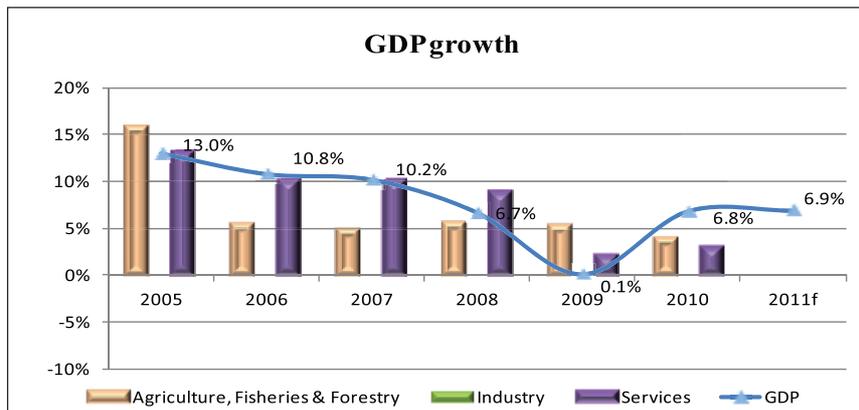
5. Policy Recommendations

Though significant efforts have been made over the past decade in restructuring in the banking sector since 2000, a lot more need to be done to further develop and enhance the safety and soundness of this sector. The most prioritised area for improvement rests with the regulatory framework. Laws and regulations need to be updated to reflect current market development and to comply with the guiding principles for effective supervision. The existing regulatory framework fails to address the issues of merger and acquisition, consolidated supervision, cross-border supervision, prompt corrective action and resolution scheme.

The NBC is moving towards risk-based supervision from the current rule-based framework. However, during this transition period, the rules and guidelines for risk-based assessment is in the development process and the risk profile is not sufficient. Adopting consistent supervisory actions most of the time is not feasible. Thus, coping with such a change proves to be very challenging.

The issue of consolidated supervision is also a constraint for effective banking supervision. Regulatory framework on a group-wide basis is still under consideration. Supervisory process, indeed, is to be conducted on group-wide basis. This is the area where the regulators lack expertise and need to be promptly equipped. The dearth of profile of the institutions within the group limits the ability to perform risk assessment appropriately. A formal coordination among all the financial regulatory and supervisory bodies within the financial system is required.

6. Concluding Remarks

Over the past several years, progress in Cambodia's banking system has been remarkable, not only in the commercial banking sector but also in the microfinance sector. The public, particularly in the provincial areas, have started to understand the role of microfinance institutions as private lending institutions and not merely NGOs giving out donations, as previously perceived. On the commercial bank side, both deposits and lending increased dramatically reflecting the improving confidence in the banking system.

This development could not have been achieved if not for the recent political stability, positive macroeconomic fundamentals and the role of the NBC as the supervisory authority in strengthening the financial and banking sector. Emphasis was placed in capacity building in order to meet the fast changing banking sector.

Rules and regulations have been revised and issued to cope with the increased exposures of banks. Despite the promising outlook, the NBC is aware of the potential vulnerabilities of the banking system and recognises the need to further enhance its supervisory' capacity and strengthen regulatory enforcement in order to cope with the future challenges.

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Chapter 3

A MACRO-PRUDENTIAL ASSESSMENT FOR INDONESIA

By

G.A Diah Utari and Trinil Arimurti[1]

1. Introduction

The Indonesian economy has shown a resilient performance amid uncertainty in the global economic situation. In spite of this success, we still face some challenges ahead which are triggered by the recent global financial crises. The main challenge for the economy is the rapid foreign capital inflows. This is closely related to the ongoing global economic condition. The excess global liquidity are searching out for places that can yield high return and the emerging market countries including Indonesia have become popular investment destinations. The good domestic economic performance combined with slow recovery of the developed nations, have become the pull and push factor for capital inflow to Indonesia and other emerging countries.

While capital inflows often help deliver the economic benefits of increased financial integration, they also create important challenges for policymakers because of their potential to generate over-heating, to increase exchange rate volatility and risk of sudden and large reversals as well as to enhance the risk of vulnerability of the financial system. Liberalisation of capital flows into a country with an inadequately developed financial system can render that country more vulnerable to crisis. For instance, credit expansion funded by foreign capital can put pressure on bank balance sheets in the event of exchange rate turmoil, exacerbating the fragility of the financial system (Calvo, et al, 1993). This was what happened in Indonesia during the crises in 1997-1998.

The important lesson learned for the central bank from the last financial crises is that macroeconomic instability originates from the financial system and maintaining low inflation is not enough to achieve macroeconomic stability.

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Therefore, the key in managing macroeconomic stability not only in controlling domestic and external imbalances, but also financial imbalances, such as credit growth, asset prices, and risk-taking behaviour in the financial system. Financial system stability is one prerequisite condition for achieving monetary stability.

The issue how to define and develop the macro-prudential policy is still under debate. In contrast to the monetary policy literature, research on macro-prudential policy is still in its infancy and appears far from being able to provide a sound analytical underpinning for policy frameworks. This may be due to two main reasons. First, the macro-prudential approach has come to play a role in policy discussions only very recently. Second, it reflects a lack of established models of the interaction between the financial system and the macro-economy.

Conceptually, macro-prudential policy is a regulatory prudential instrument which is used to achieve stability in the overall financial system, and not just the individual health of financial institutions. Therefore the central element in this definition is the notion of systemic risk that is a risk of disruptions to financial services that is caused by an impairment of all or parts of the financial system and can have serious negative consequences for the real economy.

In the context of Indonesia, since the banking supervisory function will soon be separated from the central bank, the macro-prudential policy framework will involve two institutions, namely, Bank Indonesia (BI) and Otoritas Jasa Keuangan (OJK). In this regard, the mandate for macro-prudential assesment will be held by BI while the mandate for micro-prudential assesment is given to OJK. Therefore BI needs to strengthen its role in assessing risk in financial system as a whole and as a systemic regulator.

Considering the above circumstances, to formulate the optimal design of macro-prudential policy, we need to have a clearer understanding about the macro-prudential policy framework and its related aspects, especially about the financial system risk assesment. As a first step, the aims of this research are as follows:

1) To measure systemic risk of a group of major banks using the Contingent Claims Approach (CCA);

2) To study the relationship between aggregate default probability of major banks and macroeconomic development as well as micro characteristic of banking sector; and

3) To propose policy recommendation for the optimal design of macro-prudential policy.

Following this introduction, a description of the elements of a macro-prudential framework is presented in Section 2. The methodology used for assessing systemic risk of major financial institutions is described in Section 3. Sections 4 and 5 discuss the data and empirical result, respectively. Finally the policy recommendation and concluding remarks are presented in Section 6 and 7, respectively.

2. Elements of Macro-prudential Policy Framework

2.1 Macro-prudential Policy: Definition and Objective

The issue of macro-prudential policy has become a growing concern of most central banks in the region. A fundamental concern of macro-prudential policy is that the interconnectedness of financial institutions and markets and their common exposure to economic variables may increase the riskiness and fragility of the whole financial system in ways and to an extent that will not be dependably captured by regulatory focus on individual institutions.

A shock faced by individual institutions can spread out quickly due to the interconnectedness and lead to systemic risk. This condition is worsened by pro-cyclical behaviour of those institutions in the economy. Thus, the financial system has an inherent bias toward pro-cyclicality. When there are changes in the financial market, both financial and non-financial institutions with similar risks can emit similar common reactions, creating collective behaviour that amplifies the economic cycle fluctuations.

Conceptually, macro-prudential policy is a regulatory prudential instrument which is used to achieve stability in the overall financial system, and not just the individual health of financial institution. Macro-prudential policy focuses on the interaction between financial institutions, markets, infrastructure and the wider economy.

Macro-prudential policy is needed to anticipate and mitigate financial risk. It is not always the case that the implementation of macro-prudential policy can eliminate the vulnerability of the financial system to shock. Nonetheless, having a proper macro-prudential policy in place will support the stability of the financial system, enhance market resilience toward shock and can serve as an early warning system to anticipate potential crisis in the future.

There are many views regarding the objective of macro-prudential policy. Vinals, et al (2010) mentioned that the main objective of macro-prudential policy is to maintain the stability of the financial system as a whole, by limiting the build-up of systemic risk. According to Borio and Dreahman (2009a), the goal of macro-prudential policy is limiting the risk of episodes of system-wide distress that have significant macroeconomic costs. Caruana (2010b) described the objective of macro-prudential policy as "to reduce systemic risk by explicitly addressing the inter-linkages between, and common exposures of, all financial institutions, and the pro-cyclicality of the financial system. Perotti and Suarez (2009a) viewed macro-prudential policy as aiming to discourage individual bank strategies which cause systemic risk, a negative externality on the financial system. Hanson, et al (2010) viewed that, macro-prudential policy aims at controlling the social costs of a generalised reduction of assets in the financial system. Saporta (2009) mentioned that the macro-prudential objective is ensuring the resilience of the financial system as a whole in order to maintain a stable supply of financial intermediation services across the credit cycle. The Working Group of G30 mentioned that the aim of macro-prudential policy is to improve the resilience of the financial system and reduce systemic risk inherent in the financial system that caused by the linkage (interconnectedness) between institutions, similar susceptibility to shock and the tendency of financial institutions to move in a pro-cyclical manner which increases the volatility of the financial cycle.

The Committee on the Global Financial System (CGFS) stated there are two distinguished aims of macro-prudential policy. The first is to enhance the resilience of financial system to economic downturn and other adverse aggregate shock. The second is to dampen systemic risks that arise and are propagated internally in the financial system through the interconnectedness of institutions by virtue of their common exposure to shocks and the tendency of financial institutions to act in pro-cyclical ways that magnify the extremes of the financial cycle. These two aims are not mutually exclusive. They both go beyond the purpose of micro-prudential policy, which is to ensure that individual firms have sufficient capital and liquidity to absorb shock to their loan portfolio and fundings.

Macro-prudential policy achieve the goals by: (1) preventing financial imbalances; (2) reducing systemic risk arising from inter-linkages, common exposures and procyclicality of the financial system; and (3) discouraging risk taking of financial institutions that may have systemic implication.

One concern in macro-prudential policy is to create a balance in the financial system during downswing and upswing phase in the economy. Financial firms

have a strong collective tendency to overexpose themselves to risk during upswing periods and to become overly risk averse in downturns. During upswings, as price-based measures of asset values rise and price-based measures of risk fall, financial institutions expand their balance sheets and increase leverage in order to avoid facing punishment in the equity markets. This expansion of leverage and maturity mismatch among financial institutions is one example of pro-cyclical movement. Implementing macro-prudential policy will encourage financial institutions to build up general provisions in the period of upswing in order to be prepared for the absorption of the expected future losses.

Macro-prudential policy sets a major concern in the way of the interconnectedness of financial institutions and markets, common exposures to economic variables, and pro-cyclical behaviors in creating risks. Systemic risk often come from the similar reactions of the financial and non-financial institutions in facing similar exposure, since this reactions can potentially amplify cyclical fluctuations, resulting pro-cyclicality in the financial system. In addition, the interconnectedness of financial institutions enlarges the common exposure to risk, thus magnifiying the pro-cyclical movement. One of the cases is when large capital inflow has streamed down to the emerging market economies. Macro-prudential policy allows an adjustment to the domestic reserve requirements in order to limit the build-up of domestic imbalances arising from volatile cross-border capital movements.

Monetary policy in recent years is said to have contributed to the onset of instability in the financial system by keeping interest rates low. Low interest rates trigger boom in asset prices thus encourage banks to be more willing to take risks (excessive risk taking). Macro-prudential policy may influence bank's risk taking applying regulation regarding capital requirement. Capital requirements can affect risk-taking behaviour in several ways. First, the provision of high capital will raise the entry barrier for new entrants. As a result, it will limit competition and allow existing banks to accumulate power which will make banks more cautious. Second, the high capital provisions will contribute to higher fixed cost for conducting banking business. As a result, only a few banks can fulfill the requirements. The banks that meet these criteria are more likely to act with caution in carrying out their activities. Third, as stated by Bold and Tieman (2004), stringent capital adequacy requirements will make the bank more stringent in taking risk.

The central element of macro-prudential policy is the notion of systemic risk, i.e., a risk of disruption to financial services that is caused by an impairment of all or part of the financial system, which can have serious negative

consequences for the real economy. Therefore, macro-prudential policy should focus on risks arising primarily within the financial system, or risks amplified by the financial system.

The macro-prudential perspective assumes that risk is in part endogenous with respect to the behaviour of the financial system; the micro-prudential approach assumes that it is exogenous. Since the macro-prudential approach measures risk in terms of the dispersion of an economy's output, it also recognises that the financial system has first-order effects on it. These effects are ignored in the micro-prudential perspective.

Macro-prudential policy seeks to address two specific dimensions of systemic risk (Vinals, 2011), namely, time dimension and cross-sectional dimension. Those dimensions entail different policy implications. Time dimension reflects a cumulative, amplifying mechanism that operates within the financial system, as well as between the financial system and the real economy. In time dimension, risks are associated with swings in credit and liquidity cycles. Here risk evolved overtime, referring to the financial cycle and known as the pro-cyclicality. Macro-prudential policy is performed as stabiliser by inducing a build-up of cushions in good times so that they can be drawn down in bad times. Cross-sectional dimension reflects the distribution of risk in the financial system at a given point of time. Cross-sectional dimension focuses on the concentration of risk in certain financial institutions, those institutions having similar exposures within the financial system and who have interconnected. Macro-prudential tool is focused on the risk with respect to the systemic significance of individual institutions.

Macro-prudential policy is a complement to the existing policies: monetary and micro-prudential policy which have impacts on the whole financial stability. These two policies carry a considerable level of macro-prudential aspects. However, it needs to be more focused since the last experience from crisis has justified the importance of macro-prudential policy. Macro-prudential and monetary policies are reinforcing each other. Both policies are countercyclical measures, intended to reduce the magnitude of the business and financial cycles (pro-cyclicality).

2.2 Instruments of Macro-prudential Policy

Macro-prudential policy can be thought to lie along a spectrum, with monetary policy at one end and micro-prudential policy at the other. Its objectives would be closer to those of macroeconomic policy — concerning the stability of the aggregate provision of financial intermediation services to the real economy.

But macro-prudential instruments would often be based on adapting existing micro-prudential requirements.

Macro-prudential policy uses primarily prudential tools on an on-going basis and as needed to limit systemic or system-wide financial risk, thereby minimising the incidence of disruptions in the provision of key financial services that can have serious consequences for the real economy.

The literature has highlighted several important distinctions. One important distinction is between tools geared towards addressing the time-series dimension of financial stability, i.e., the pro-cyclicality in the financial system, and tools that focus on the cross-sectional dimension, i.e., on the distribution of risk at a point in time within the financial system / contributions to systemic risk of individual institution. IMF (2011) classified macro-prudential tools in two categories: (1) Instruments specifically tailored to mitigate the time-varying or cross-sectional dimensions of systemic risk, and (2) Instruments not originally developed with systemic risk, but can be modified to become part of the macro-prudential toolkit, provided that: (a) they target *explicitly* and *specifically* systemic risk; and (b) the chosen institutional framework is underpinned by the necessary governance arrangements to ensure there is no slippage in their use. Instruments in these two categories are presented in Table 1.

Another distinction is between rules (built-in stabilisers) and discretion in calibrating the roles of macro-prudential policy (Borio and Shim, 2007). By analogy, rule-based macro-prudential tools, e.g., automatic stabilisers appear appealing (Goodhart, 2004) in Galati and Moesser (2011). Loan loss provisions, capital requirement/capital surcharges, or loan-to-value ratios, for example be designed in a rule-based way. One important built-in stabiliser is risk management practices that internalise the risk of the build-up of financial imbalances and their unwinding (Borio and Shim, 2007) in the same paper. The discretionary tools, like supervisory review or warnings, are also likely to play an important role since the next crisis is likely to take on a different form from the current one. One commonly used discretionary tool is the issuance   of warnings about the build-up of risk in the system. Other discretionary tools that can play an important role include supervisory review pressure or quantitative adjustments to the various prudential tools (Hibers, et al, 2005) in Galati and Moesser (2011).

Table 1
Macro-prudential Instruments (IMF)

Tools	Risk Dimensions	
	Time Dimension	Cross-Sectoral Dimension
Category 1. Instruments developed specifically to mitigate systemic risk		
	1. Countercyclical Capital Buffer	1. Systemic capital surcharges
	2. Through -the -cycle valuation of margins or haircuts for repos	2. Systemic liquidity surcharges
	3. Levy on non-core liabilities	3. levy on non core liabilities
	4. Countercyclical change in risk weights for exposure to certain sector	4. Higher capital charges for trades not cleared through CCPs
	5. Time-varying systemic liquidity surcharges	
Category 2. Recalibrated instruments		
	1. Time-varying LTB, Debt To Indome (DTI) and Loan to Income (LTI) caps	1. Powers to break up financial firms on systemic risk concerns
	2. Time varying limits in currency mismatch or exposure	2. Capital charge on derivative payables
	3. Time varying limis on loan to deposit ratio	3. Deposit insurance risk premiums sensitive to systemic risk
	4. Time varying caps and limits on credit or credit growth	4. Restrictions on permissible activities (e.g. ban on proprietary trading for systemically important banks)
	5. Dynamic provisioning	
	6. Stressed VAR to build additional capital buffer against market risk during a boom	
	7. Rescaling risk-weights by incorporating recessionary conditions in the probability of default assumptions (PDs)	

Source: Vinals, et al. (2011).

One can also distinguish the tools of macro-prudential policy based on quantity restrictions and those based on price restrictions. This distinction is introduced by Perotti and Suarez (2010), who show that in the presence of externalities the two types of policy instruments can have different welfare outcomes, if there is uncertainty about compliance cost. Price-based tools taxes fix the marginal cost of compliance and lead to uncertain levels of compliance, while quantity-based tools fix the level of compliance but result in uncertain marginal cost. One of the instruments for price-based tools is the Pigouvian tax, which is aimed at equating private and social liquidity costs to that of quantity regulations, such as net funding ratios. Among the quantity restrictions, Hanson, et al (2010) make the further distinction between ratios and absolute values in the context of the discussion of principal component analysis (PCA) targeted at bank capital.

BIS (2008) provides an example of a taxonomy of macro-prudential tools as presented in Table 2.

Table 2
Macro-prudential Instruments (BIS)

1. Risk measurement methodologies	Examples
By banks	Risk measures calibrated through the cycle or to the cyclical through
By supervisors	Cyclical conditionality in supervisoty ratings of firms; Develop mesure of systemic vulnerability as a basis for calibration of prudential tools
2. Financial reporting	3. Levy on non-core liabilities
Accounting standars	Use of less procyclical accounting standards; dynamic provisions
Prudential filters	Adjust accounting figures as a basis for calibration of prudential tools; Prudential provisions as add-on to capital; smoothing via moving averages of such measures; time varying target for provisions of for maximum provision rate.
Disclosures	Disclosures of various types of risk (e.g. credit, liquidity), and of uncertainty about risk estimates and valuations in financial reports or disclosures.
3. Regulatory capital	
Pillar 1	Systemic capital surcharge; Reduce sensitivity of regulatory capital requirement to current poin in the cycle and with respect to movements in measured risk; Introduce cyle-dependent multiplier to the point-in-time capital figure; Indreased regulatory capital requirements for particular exposure types.
Pillar 2	Link of supervisory review to state of the cycle
4. Funding liquidity standards	cyclically-dependent funding liquidity requirements; concentration limits; FX lending restrictions; FX reserve requirements; currency mismatch limits; open FX position limits
5. Collateral arrangements	Time-varying Loan -to-value (LTV) ratios; Conservative maximum loan-to-value ratios and valuation methodologies for collateral; Limit extension of credit based on increases in asset values; Through -the cycle margining
7. Compensation schemes	Guidelines linking performance-related pay to ex ante longer-horizon measures of risk; bank-loading of pay-offs; Use of supervisory review process for enforcement.
8. Profit distribution restrictions	Limit divident payments in good times to help build up capital buffer in bac times
9. Insurance mechanisms	Contingent capital infusions: Pre-funded systemic risk insurance schemes finance by levy related to bank asset growth beyond certain allowance; Pre-funded deposit insurance with premia sensitive to macro in addition to micro parameters
10. Managing failure and resolution	Exit management policy conditional on systemic strength; Trigger points for supervisoty intervention stricter in booms than in periods of systemic distress

Source: BIS (2008).

The CGFS divided macro-prudential policy instruments into 5 categories, namely: (1) Measures imposed on particular credit markets; (2) Measures targeting balance sheet size/composition of banks and other financial institutions; (3) Measures addressing capital flow volatility; (4) Tools communicating macro-prudential risk assessments of authorities; and (5) Inputs to macro-prudential assessments.

Indonesia has implemented several instruments considered as macro-prudential policy to address a number of challenges to Indonesia's economy. Based on the categorisation of the CGFS, the policies applied by Indonesia are stated in Table 3.

Recognising the complementary nature of macro-prudential and other areas of economic policy, the authorities charged with implementing macro-prudential policy, whether through a new coordinating organisation or as part of an existing institution, must inform and be informed by monetary, fiscal, and other government policy, while giving due regard to the primary responsibility of other entities in these areas.

Table 3
Macro-prudential Instruments in Indonesia

Macro-Objective	Instruments & Date Implemented	Objective of the Instrument
Measures imposed on particular credit market		
Credit Policy	Bank is prohibited to give Rupiah lending to non residents (2005)	to maintain Rupiah stability
	Implementation of minimum reserve requirement based on LDR	to give stimulus to credit growth and limit bank's risk taking behavior by giving dis-insentif when LRD ratio in the range of 78<=LDR<=100
	Provisioning of property credit is decreased from 50% to 40% (2006) and will be decreased to 35% with LTV (80%) in 2010-2011. Property credit to be charged with this risk weight is credit that is guaranteed by user.	To support the health property credit
Measured to address capital flow volatility		
	Minimum holding period for BI bills, 1 month holding period (June 2010) and 6 month holding period (May 2011)	To "put sand in the wheel on short term and speculative capital inflow" and mitigate the risk of sudden revearsal
	Shifting BI bills 1 month to Term Deposits 9 and 12 month	To lock up domestic liquidity to longer term and limits the supply BI bills in the market.
	Increase FX reserve of the banks from 1% of FX deposits to 5% (March 2011) and to 8% (June 2011)	To strengthen FX liquidity management, thereby increase the resilience of the banking system in facing increasing FX
	Reinstate limits on short-term offshote borrowing of the banks (maximum of 30% of capital) (January 2011)	To limit the short-term and volatile capital inflow and to limit FX exposure of the banking system stemming from capital inflows
Measured to manage domestic liquidity		
	Lengthen auction of BI certificate (from weekly to monthly) and offer longer maturity (3,6,9 months) (June 2010)	To enhance the effectiveness of domestic liquidity management, including from capital inflows, by locking up to longer term and help develop domestic financial market.
	Increase Rupiah reserve requirement from 5% to 8% (November 2010)	To absorb domestic liquidity and enhance liquidity management of the banks, without exerting negative impact on lendings that are needed to stimulate growth.
Tools to communicate macroprudential risk assesment of authorities		
assessment of macroprudential risk	Financial System Stability Assesment	To improve public understanding regarding financial stability issue and risk assesment conducting by BI
Inputs to macroprudential		
	Household survey	
	Probability of default & Recovery Rate Survey	
	Credit Information Bureau (2006)	
	Financial Stability Index	To measure performance of financial system stability as a whole (banking system, stock market and bond market)
	Macro Stress Test (2007)	To measure financial sector resilience toward macroeconomic shocks.
Measures targeting balance sheet size/composition of banks and other financial institutions		
interconnectedness in the financial system	Intensif supervisoty especially to systemic institution (2008)	To reduce interconnnectedness in the banking system and to limit risk taking by systemically important bank
	Banks are prohibited to give credit to related party more than 10% of total capital (2005)	
b. Limiting increasing risk in the financial system and specific financial risk	Minimum Reserve requirement (min. 2,5% of total deposit) in the form of BI certificate, government bond or cash (2008)	To increase buffer of banks to anticipate liquidity risk.
	Banks are prohibited to c onduct derivative sructure product transaction using foreign exchange transaction underlying	To limit market risk especially exchange rate risk
	To limit banks' net open position by 20% of total capital (2004)	
	Provisioning using the concept of impairment (formerly using the concept of expected loss)	Provisioning calculation is based on asset fairness condition (based on PSAK 50/55)
c. Monitoring banks' liquidity resilience	Monitoring liquidity resilience using 2 liquidity ratio i.e. (1) core funding rasio and (ii) net stable funding ratio (2010)	To reduce liquidity risk in the banking system
	Monitoring bank's daily liquidity position and liquidity projection of systemic bank (2008)	

3. Data & Methodology

3.1 Data

The estimations are based on aggregate monthly data of probability of default of 10 major banks in terms of total assets. The data cover the period from January 2001 to December 2010. The data used for the analysis is defined in Table 4 below.

Table 4
Data

Variabel	Definition	Source
ldp	default probability	calculation from aggregate data of top 10 banks
leverage	long term liabilities to total capital	Bank Indonesia
npltotk	rasio npl to total credit	Bank Indonesia
ldeposit	total deposit	Bank Indonesia
lihsg	stock market index	CEIC
lcpi	consumer price index	Bank Indonesia
gpdbriil	real economic growth (GDP is interpolated from quarterly data)	Bank Indonesia

All the data are in terms of log except for leverage, npltotk and gpdbriil.

3.2 Framework for Assessing Systemic Risk of Major Financial Institutions: Theoretical Concept

Macro-prudential policy requires a capacity to identify systemic risks early enough so that timely action can be taken to support financial stability. Ideally, systemic risk measures would be linked to macro-prudential policy goals and tools. For macro-prudential policy purposes, aggregate risk monitoring should be robust, forward-looking, and contrarian. Risks tend to build up during periods of boom. Therefore, tools measuring systemic risk need to provide adequate lead time for the policy response to attenuate the cyclical impact of mounting vulnerabilities.

There is a vast literature addressing the development of measures and indicators on the causes of systemic risk. Systemic risk measures should contain information about, or be linked to macro-prudential policy objectives. In particular, they should: (i) contain information of a build-up of systemic risk in both the

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time and cross-sectional dimensions; (ii) be assessed accurately and with minimum possible lags; and (iii) have forecasting power for financial instability and output shocks.

In the time dimension, indicators to assess risks related to pro-cyclicality can be categorised by main sources and propagation channels: (1) Macro aggregates and forecasts (domestic, external, and sectoral imbalances), as natural indicators of the state of business and financial cycles; (2) Leverage ratios in the financial, corporate, and household sectors, as other measures reflecting the stages of financial cycles; (3) Credit-to-GDP gap measures; (4) Balance sheet indicators of financial institutions related to stages of a financial cycle (especially ratios of non-core to core liabilities to indicate liquidity risks); (5) Asset prices; (6) Various value-at-risk (VaR) models that are widely used to capture the relationships between macroeconomic and financial variables; and (7) Macro stress tests to assess how the financial system would react to a macroeconomic shock.

In the cross-sectional dimension, tools for identification and measurement of risks related to interconnectedness use several key approaches. The key approaches include among others (1) Contingent claims analyses (CCA) that build risk-adjusted balance sheets for financial institutions and sovereigns; (2) Probabilities of distress for groups of financial institutions and other measures of distress dependence, using equity price or credit default swap (CDS) spread data; and (3) Measures of financial institutions' contribution to systemic risk, such as network analyses based on bilateral and common (similar) exposures that can help to assess the potential for solvency or liquidity shocks affecting one financial institution to spill over across banks or countries.

Related to country application, Indonesia uses an indicator called the Financial Stability Index (FSI) to measure the performance of the financial system as a whole which comprises banking sector, stock market and bond market. This indicator helps to identify the potential pressure in the financial system. A high value rating of the FSI reflects deterioration in the financial stability and vice versa. The FSI is updated monthly and simulation is conducted on a regular basis to support the analysis of the FSI.

While a wide range of approaches have been developed in recent years to measure systemic risk, selecting the best tools to guide macro-prudential policy is still a challenge. To date, no tool has proved sufficiently reliable to predict financial stress and guide policymakers. Therefore, establishing a stronger early warning capacity is a major priority for further work.

The CCA was developed from modern finance theory and has been widely applied by financial market participants to measure the default probability of a firm based on the market prices of the firm's debt and equity.

The CCA has several advantages compared to other indicators. First, it uses market data such as equity prices and volume and interest rates, which incorporate market forward-looking expectations. Other indicators, such as non-performing loan ratios and provisioning, reflecting the static bank risk are more related to backward-looking data. Second, compared to other indicators, the CCA employs high frequency observations, thus reflecting more current condition in the market.

The CCA basically estimates the probability of an entity to default on its obligations. The CCA is a structural model based on the Black-Scholes and Merton model. The CCA can be applied to construct a marked-to-market balance sheet that reveals underlying risk by combining information from the balance sheet and the common finance and risk management tools. In the financial market, this tool has been generally used to estimate the creditworthiness of a corporate or to measure bank riskiness.

Consider a case of a firm with assets, V, which are financed by debt obligation, F, and Equity, E. The value of the firm's assets is simply the sum of the firm's debt and equity:

$$V_t = F_t + E_t \ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(1)$$

The value of the firm's debt obligation is also known as the default barrier, DB. The probability of default ($V_{t+1} < F_{t+1}$ or DB) exists as long as it is greater than zero. This implies that at time t+1, the market value of assets, B_t, is lower than the yield to maturity of the debt, Fe^{-rT}. In this simplified firm structure, the risk is a function of the leverage ratio, $LR = Fe^{-rT}/B_t$, the volatility of the rate of return of the firm's assets, o_v, and the time to maturity of the debt, T. Thus, for a creditor who extended a loan to this firm must purchase a put option to eliminate the risk on the loan[2]. The value of the put option, P_o, on the market value of the firm assets, B_t, for the term of the debt must have a strike price, S, equal to the face value of the loan. The creditor can completely eliminate

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2. A put option is a contract between two parties to exchange assets for an agreed amount (strike price) at a specified future date. The buyer of the put, has the right but not the obligation to sell the asset at the strike price. The seller has the obligation to buy the asset once the buyer exercises his right.

the credit risk and convert the risky loan into a riskless loan. If the riskless interest rate is r, then in equilibrium it should be that:

$$B_t + P_o = Fe^{-rT} \quad ....(2)$$

In applying the Black-Scholes and Merton model, the value of the put can be written as:

$$P_o = -N(d_1)B_t + Fe^{-rT} N(d_2) \quad ....(3)$$

Where P_o, is the current value of the put, $N(.)$ is the cumulative standard normal distribution, μ is the expected return on the assets, and σ_v is the standard deviation of the rate of return of the firm's assets.

$$d_1 = \frac{\ln(\frac{B_t}{F})+\left(\mu+\frac{1}{2}\sigma^2\right)T}{\sigma_v\sqrt{T}} = \frac{\ln(\frac{B_t}{Fe^{-rT}})+\left(\mu+\frac{1}{2}\sigma^2\right)T}{\sigma_v\sqrt{T}} \quad ....(4)$$

$$d_2 = d_1 - \sigma_v\sqrt{T} \quad ....(5)$$

The numerator measures the distance between the expected one-year ahead market value of the firm's assets and the distress barrier. The denominator is used to scale the numerator with respect to units of standard deviations. Thus, the probability of Default, $(V_{t+1} < F_{t+1} \text{ or } DB)$ is as follows:

$$\text{Probability of default} = N\left(-\frac{LN\frac{V_0}{DB}+(\mu-\frac{\sigma_v^2}{2})T}{\sigma_v\sqrt{T}}\right) \quad ....(6)$$

Using Equation (5), the expected return on assets, μ, can be computed as follows:

$$\mu = \max\left[\frac{v_{A,(t)}-V_{A,(t+1)}}{V_{A,(t+1)}}, r\right] \quad ....(7)$$

where r, is the one year Treasury Bill rate, and T is set to one year so that the probability emerging out of the assessment is the one year ahead probability of default on an *ex ante* basis.

Moreover, the equity of the firm, E_t, is itself a contingent claim on the firm's assets. Since equity holders have a junior claim on the residual value of the assets, the value of the equity can be viewed as a call option. This means that equity holders receive the maximum of market value assets minus the default

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barrier or nothing in case of default. Given that the firm's equity behaves like a European call option on the firm's assets, the Black-Scholes and Merton model can be used to compute the equity value. The equation for valuing equity as a European call option is:

$$E_t = V_t \, N(d_1) - Fe^{-rT} \, N(d_2) \quad ....(8)$$

3.3 Estimating Banking Sector Risk Using the Contingent Claims Approach (CCA)

In the theoretical concept, it is shown that the Black-Scholes and Merton model can be applied to calculate risks in the financial system by showing the distance of institutions from the default barrier and estimating the probability the default. In cases where the debt and equity are both traded, the market value of assets, V, can be reconstructed by adding the market values of both debt and equity as stated in Equation (1). However, practical problem arises in cases where the firm's debt is not traded and only equity is traded or vice versa. For this project, the data on the top big banks are limited only to institutions where there are available equity prices. The default barrier (Fe^{-rT}) is determined as a function of the short-term debt and half of long-term liabilities of the firm.[3]

Figure 1
The Concept of CCA

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3. Crouhy, Michel, et.al., (2001), Risk Management, 1st Edition, pp. 371-374.

According to the Vasicek and Kealhofer empirical model,[4] firms default when the asset value reaches a level that is somewhere between the value of the total liabilities and the value of the short-term debt. Therefore, the tail of the distribution of asset values below the total debt may not be as accurate as a measure of actual probability of default. The loss of accuracy may result from the non-normality of the asset return distribution or the firm is able to draw on lines of credit (unobservable). Thus, the default barrier is computed as the sum of short-term debt plus half of the long-term debt.

For the market value of equity, E_t, it is equal to the number of outstanding stocks multiplied by the closing stock price as of the balance sheet date. To calculate a single systemic risk indicator, an aggregation technique based on the weighted average market value of assets is used.

3.4 VECM Method and Stress Test

A vector error correction (VEC) model is a restricted VAR designed for use with nonstationary series that are known to be cointegrated. The VEC has cointegration relations built into the specification so that it restricts the long-run behaviour of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustment dynamics. The cointegration term is known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments.

Consider an unrestricted VAR of a vector of several variables which can be written as:

$$X_t = \mu_t + \sum_{i=1}^{k} A_i X_{t-1} + v_t \quad \text{...(9)}$$

X_t is vector of endogenous variables (ldp, gpdbriil, leverage, npltotk, ldeposit, lihsg)

μ_t is vector of exogenous variables (constant)

A_i is matrix coefficient (k x k)

v_t is vector of residual

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4. The most popular commercial model is the Kealhofer, McQuown and Vasicek (KMV) model.

The VEC model can be derived from the VAR model.

$$\Delta X_t = \mu_t + \Pi X_{t-1} \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-1} + e_t$$ ....(10)

Π and Γ function of A_i. Matrix of Π can be decomposed into 2 matrix where

$\Pi = \alpha\beta\Gamma$, where α is adjustment coefficient that measures the speed of adjustment of the i-th endogenous variable toward the equilibrium and β is cointegrating vector.

In this study the estimation of VECM model is conducted on several steps which is illustrated in the diagram below.

Figure 2
VECM Method
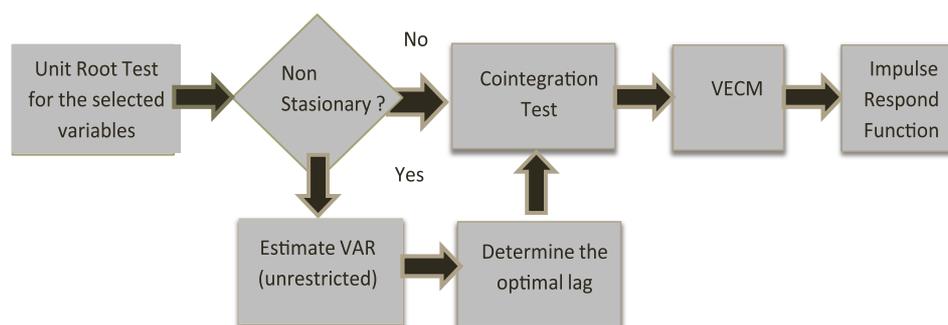
The first step is test to find whether the series are stationary using Unit Root Test. The second step is to determine the optimal lag based on Akaike Information Criterion (AIC). The next step is to perform cointegration test using the Johanses Juselius method. Furthermore, to obtain the pattern of dynamic adjustment of the VECM model, we conduct the generalised impulse response function of the LDP to one standard deviation shock to other endogenous variables. The advantage of this method is it is insensitive to the order of the variables (Pesaran and Shin, 1998).

The impulse response estimated by the VECM model can be used to perform stress test. We perform financial stability shock and bank-run shock which is represented by 10% increase in NPL shock and 10% decrease in total deposits, respectively. The shock of 10% increase or decrease in the designated variables

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are calculated based on the average value of the variable during the sample period. The stress test estimation is illustrated in the diagram below.

Figure 3
Stress Test
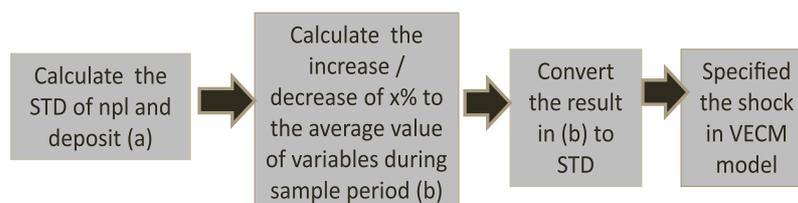
4. Empirical Results

Using the CCA formula as explained above, based on the aggregate data of the 10 largest banks, the probability of default[5] tended to increase in the period 2004-2010. During the period of 2008-2010, the default probability increased quite high reaching more than 20%. This condition occured during the period of the global financial crises. However, when extended to mid-2011, it showed a decreasing pattern, indicating banks' lower risk of default. Improvement in the overall Indonesian economic performance during 2011 has brought positive impacts on most sectors in the economy, including the banking sector. In aggregate, the major banks experienced the lowest leverage in the last decade. Although their liabilities have risen, their total assets have grown even higher. Meanwhile, a sharp increase in most of the banks' share prices since 2008 has caused their market value of capitalisation to move up steeply, thus leading to the highest market value of asset. On the other hand, the asset volatility has dropped significantly, end in much lower probability of default in 2011.

The pattern of this indicator is also in line with the FSI index[6] (Figure 4). It is supported by the quite high correlation between both indicators (70%). This also means that the estimation of probability of default is good enough to represent the risk condition in the major banking sector.

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5. Probability of default calculation is not normalised in its z value.

6. The Financial Stability Index (FSI) is an indicator to measure financial stability. FSI in Indonesia is developed from three main blocks in the financial system, namely, the banking sector, stock market and bond market. A value greater than 2 means there is pressure to financial system stability.

Figure 4
Probability of Default (in %) and FSI Index
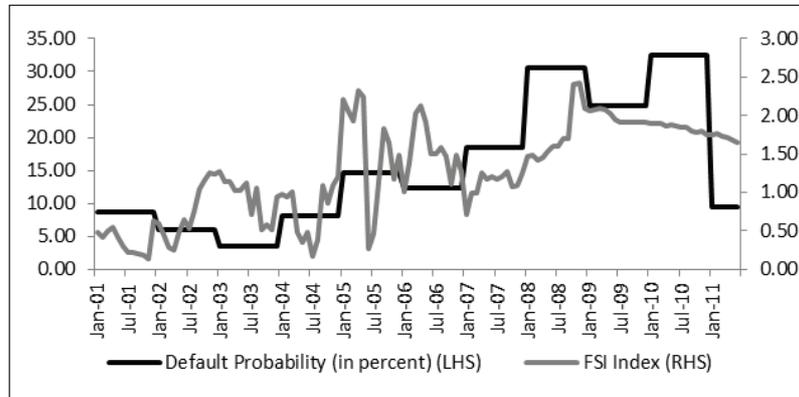
Difference among the two measures is possible because the FSI index gives greater weight to the NPL ratio in the measurement of risk, while the default probability focuses on price movements of bank's asset which incorporates forward-looking assessment by the market participant.

The test of unit root using Augmented Dicky Fueller Test indicates that all variables used in the estimation appear to be non-stationary, i.e., they have unit roots and are I (1) variables (Table 5).

Table 5
Unit Root Test

Variabel	level (no trend, no constant)		level with constant	level with trend + constant
log(dp) =ldp	0.8712		0.8549	0.3042
leverage1	0.0002	***	0.2864	0.1440
npltotk	0.0127	*	0.1095	0.1481
log(deposit) = ldeposit	0.9947		0.9989	0.6553
log(cpi) = lcpi	1.0000		0.5167	0.7186
gpdbriil	0.6935		0.3084	0.5079
log(ihsg) = lihsg	0.9868		0.9010	0.2970

In the analysis of time series data, it is possible to show that even though all the series prove to be non-stationary, a linear combination of them may nevertheless be stationary, i.e., combination of such variables may have cointegrating relationships.

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Furthermore, to determine the optimal lag, we estimate the unrestricted VAR of the endogen variables. The selection of optimal lag is conducted using the AIC criterion. The result of unrestricted VAR shows that the optimal lag length is 2.

Table 6
Optimal Lag Length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	342.9638	NA	5.85E-12	-5.999354	-5.829448	-5.930418
1	1464.653	2083.137	2.81E-20	-25.15452	-23.79527	-24.60303
2	1596.743	228.799	6.44e-21*	-26.63827*	-24.08968*	-25.60423*
3	1629.72	52.99843	8.79E-21	-26.35214	-22.61421	-24.83554
4	1659.084	43.52151	1.31E-20	-26.0015	-21.07422	-24.00235
5	1719.011	81.33	1.17E-20	-26.19663	-20.08001	-23.71492
6	1750.768	39.12867	1.80E-20	-25.88871	-18.58275	-22.92445
7	1790.553	44.04799	2.55E-20	-25.72416	-17.22886	-22.27735
8	1869.198	77.24025*	1.95E-20	-26.25353	-16.56888	-22.32416

* Indicates lag order selected by the criterion.

In order to see the long-run relationship between probability of default and other variables, the cointegration test is performed as showed in Table 7. The Trace Test indicates that we can reject the hypothesis that there exist no cointegrating relationship at the 5% significance level[7]. The result indicates that there is only one cointegrating relationship between the aggregate probability of default of major banks and the macro variables and bank's micro variables.

The relationship has been normalised on the basis of probability of default (LPD) since our primary interest is in the effect of the macroeconomic variables and micro characteristics of banking system on LPD.

Table 7
Test for Co-integrating Relationship

Rank Test	lag opt =2	5% critical value	P value
r=0		125.6154	0.0262
r≤1		95.7537	0.1378

_____

7. However, it should be noted that we cannot reject the null hypothesis that the number of cointegrating vectors is less than or equal to one (rd"1).

The VECM estimation for long-run relationship is shown in Table 8. Table 8 shows the estimated adjustment coefficient (α) and parameter coefficient for cointegration relationship between variables (β). The adjustment coefficient or the error correction terms (α) for probability of default (LDP) is negative and significant, indicating the convergence of variables towards long-run equilibrium. The result indicates that in the long run, economic growth (GPDBRIIL) and the movement of stock price (LIHSG) affect the agggregate probability of default of the 10 banks. As expected, GDP growth riil proves to have a negative effect on the default probability. Better economic conditions will increase the number of profitable projects, thus reducing the probability of default. Additionally, it also will reduce the level of defaults on existing loans and new credits.

The other variable that affects the probability of default significantly is the index of stock market (IHSG). This variable expresses the performance of the whole stock market in Indonesia. It represents the investors' sentiment on the state of the Indonesian economy. The increasing stock market index will also raise the probability of default. This positive effect of the stock market index to probability of default might be related to the possible existance of asset price bubble. This finding has sent a signal to elaborate the asset price bubble risk more since it can create a threat to financial stability.

To determine the pattern of dynamic adjustment of probability of default when a one standard deviation shock is given to the endogenous variables, we perform generalised impulse response. The results are displayed in Figure 5. GDP growth riil and banks' deposits proves to have a negative effect on the default probability while index of stock market and non-performing loans have positive effect.

Table 8
Estimated β for Cointegration Relationship and α for Adjustment Coefficient

	β		α	
	Coeff	T-values	Coeff	T-values
LDP	1.0000		-0.1122	[-3.82659]
GPDBRIIL	-0.5881	[3.64373]	-0.0348	[-3.31779]
LCPI	-0.9603	[0.33779]	-0.0024	[-1.21386]
LIHSG	2.2231	[-5.01608]	0.0155	[0.94309]
LDEPOSIT	-1.3948	[1.28312]	0.0031	[0.64523]
NPLTOTK	0.0551	[-0.01747]	0.0015	[0.69407]
LEVERAGE1	0.3416	[-0.67421]	0.0000	[-0.00085]

β : Cointegration Relationship, α : Adjustment Coefficient

Figure 5
Generalised Impulse Response

Response to Generalized One S.D. Innovations
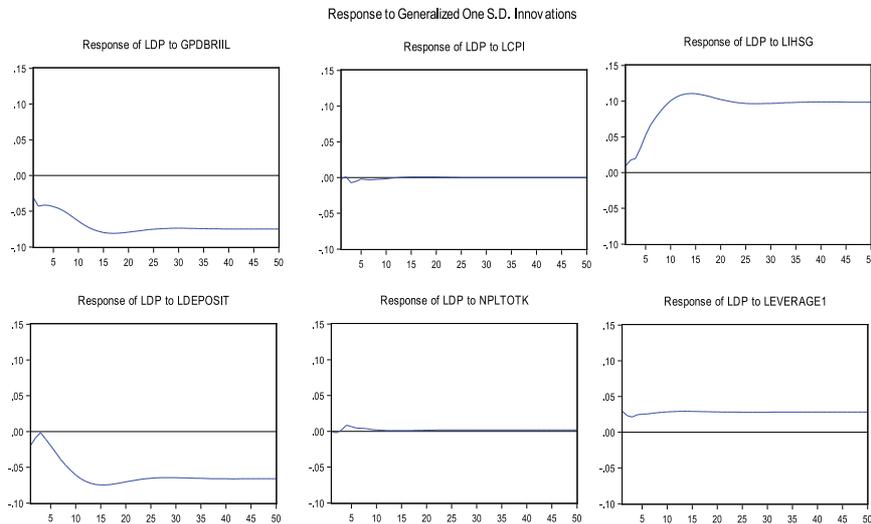
The first left graph shows that the shock of one standard deviation on GDP growth riil would decrease probability of default by 3% in the first place and continually increase until it stables at the value of around 8% after 20 months. Similar reaction comes from deposit variable when the same shock is delivered. It will decrease the probability of default gradually until it becomes stable at the value of 7% after 20 months.

On the other hand, when a similar amount of shock is given to the other variables, a positive reaction is acquired. When the shock is passed on the stock market index (IHSG), the probability of default will gradually increase until it becomes stable at the value of 10 % after 20 months. The same pattern also applies to the variable leverage. The one standard deviation shock on leverage will increase the probability of default gradually until it becomes stable at the value of 3% after 15 months. The shock on NPL also increases the probability of default although the amount is quite small, which is around 0.15%. On the contrary, the shock of one standard deviation to the CPI does not show any impact.

In order to see the impact of a bank run and financial stability shock on the default risk, a stress test is performed by decreasing 10% of deposit and increasing 10% of NPL. The result shows that for the same degree of shock,

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bank-run shock (10% decrease on deposit) will render higher impact to the increasing of probability of default compared to financial stability shock (10% increase on NPL) (Figures 6 and 7). This result is reasonable since bank-run shock has greater contagion effect on other banks, especially if bank-run shock materialises in the major banks.

Figure 6	Figure 7
Stress Test - Financial Stability Shock (10% increase in NPL shock)	**Stress Test – Bank-run Shock (10% decrease in total deposit)**
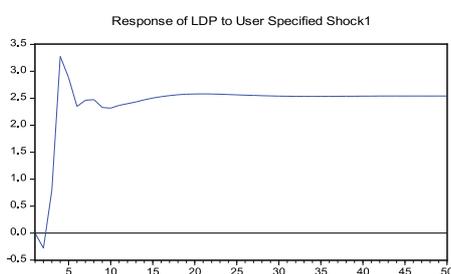
Response of LDP to User Specified Shock1

Response of LDP to User Specified Shock1
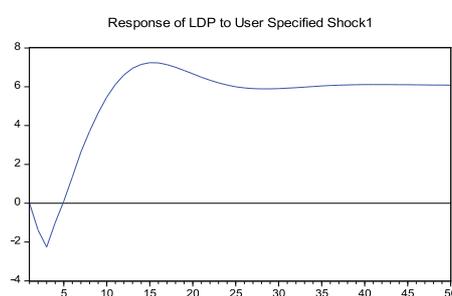
5. Conclusion

The aggregate default probability of the top 10 banks in terms of total assets using the CCA approach tends to increase in the period of 2004-2010. During the period of 2008-2010, the default probability increases quite high which is more than 20%. This condition occured during the period of global financial crises. However, when extended to the most current year in 2011, it now tends to decrease. The pattern of this indicator also in line with the FSI index . This means that the estimation of probability of default using the CCA approach is good enough to represent the risk condition in the major banking sector.

The empirical result shows there is cointegration relationships between the aggregate probability of default of major banks and the macro variables and bank's micro variables. In the long run, GDP growth riil proves to have a negative effect on the default probability while the stock market index has a positive effect on the default probability. The positive effect of stock market index on the probability of default in the long run may be related to the possible existence of asset price bubble. This finding has sent a signal to elaborate the asset price bubble risk more since it can create a threat to financial stability.

The pattern of dynamic adjustment of probability of default when there is a shock of one standar deviation to the endogenous variables shows that GDP growth riil and banks' deposits have a negative effect on the default probability. On the other hand, stock market, leverage and non-performing loans have positive effect.

When the two scenarios of shock are applied in the stress testing, the results indicate that, for the same degree of shock, the bank-run shock (the decrease in total deposits) has a higher impact on the probability of default as compared to the financial stability shock.

5.1 Policy Recommendations

Based on the results of this study, several implications are suggested as policy recommendations:

a) The application of the CCA can be used to identify macrofinancial vulnerabilities that lead to systemic risk. Given that the computation can be performed only on banks that have equity data, it is suggested that authorities also consider any other indicators/ variables and qualitative information available to them to measure the system-wide risk. The calculation of systemic risk using the CCA method becomes very relevant because the risk indicators obtained are forward looking. Thus, it can be an important indicator to reveal the systemic risk in the banking sector.

b) The application of the CCA to measure systemic risk requires a sustainable and accurate supply of information / data especially banks' balance sheet data. Problems may arise when the banking supervision function is separated from the Central Bank and transferred to the Financial Service Authority. Therefore it will need a strong coordination and good flow of information between the two institutions.

c) One important key issue in the design of the framework for macro-prudential policy is whether financial imbalances play a role in the monetary policy framework. Therefore further analysis regarding the relation between monetary policy and variables in the financial market should be strengthened to support the design of macro-prudential policy.

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Chapter 4

A MACRO-PRUDENTIAL ASSESSMENT FOR KOREA

By
Kiwon Kim[1]

1.   Introduction

The recent financial crisis has proved that financial stability cannot be achieved only by market discipline and micro-prudential policy, and this recognition has brought the macro-prudential policy framework to the fore of policy task. However, there is no conceptual consensus on what is macro-prudential and how we can accomplish this goal: specification of objectives, elements, policy instruments, implementation, and governance structure of the macro-prudential policy. Probably, the lack of this consensus reflects differences in the structure of the financial system and in the stage of financial development among the developed and emerging market countries. It is still under discussion (Committee on the Global and Financial System, 2010).

Even though the emerging market countries did not directly experience the global financial and economic crisis, they suffered from severe instability in their own financial markets and foreign exchange markets resulting from capital outflows caused by the developed countries' capital retrieval (sudden stops). The spillover of the global financial crisis to Korea triggered capital outflows associated with financial develeraging by international banks (foreign bank branches in Korea) and foreign investors. In response to these capital outflows, Korea introduced new macro-prudential policy instruments. These measures are generally appraised as successful.

First, this country report explains capital outflows during the global financial crisis and the policy responses: the implementation of new macro-prudential policy instruments. Next, it deals with the framework for assessing systemic risk of the major Korean banks, including contingent claims approach. The last section concludes.

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2. Capital Flows and Implementation of New Macro-prudential Policies in Korea

2.1 Capital Flows during the Global Financial Crisis in Korea

After the 1997 currency crisis in Korea, the main policy framework adopted by Korea was a combination of a free floating exchange rate system, inflation targeting and enhanced financial liberalisation (Kim, et al., 2009). Korea has opened its domestic financial and capital markets step by step. The capital markets in Korea have now been opened in almost all areas, including equities and bonds investment. Also, overseas investment by residents has mostly been liberalised. As a result, capital inflows to and outflows from Korea have increased greatly. With the deepened linkage between domestic and international financial markets, the domestic financial and foreign exchange markets are now significantly influenced by overseas factors.

As shown in Graph 1, Korea recorded large surpluses in both its current and capital accounts, the twin surpluses in the balance of payments in Korea created a huge excessive supply of foreign capital into the Korean capital and foreign exchange markets.

From the early 2000s until the 2008 global financial crisis, Korea experienced large amounts of net capital inflows, encouraged by the nation's promising economic growth and stable macro-economic environments.

The surge in capital inflows into Korea led to exchange rate appreciation, accumulation of large foreign exchange reserves as a result of smoothing operations by the Bank of Korea, and initiation of policy measure such as liberalisation of capital outflows by the removal of restrictions on overseas securities and real-estates investments by individuals.

Graph 1
Trends of Balance of Payments
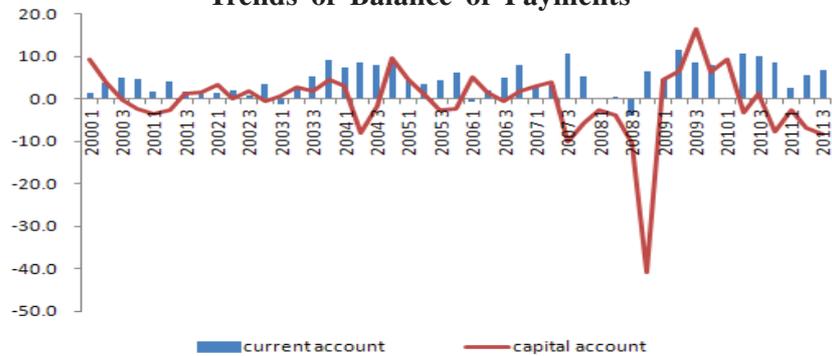
Source: Bank of Korea.

Table 1
Trends of Net Capital Flows in Korea

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
net Direct Investment	4.8	1.3	-0.6	-0.6	3.6	-0.1	-7.6	-17.9	-16.9	-14.9	-22.2
net Portfolio Investment	12.2	6.7	0.3	17.3	6.6	-3.5	-23.2	-26.1	-2.4	49.7	42.5
(Equity)	12.6	9.8	-1.1	12.4	5.8	-0.4	-23.7	-81.3	-26.5	22.7	20.7
(bonds)	-0.4	-3.1	1.4	4.9	0.8	-3.1	0.4	55.2	24.1	27.0	21.8
Bank Borrowings	-7.1	-10.1	6.7	-9.5	-3.3	1.3	42.9	32.8	-34.3	8.2	-15.2
net Trades Credits	1.4	-4.3	1.7	2.6	3.7	5.8	4.5	-1.1	0.1	-1.2	-0.4
Others	-0.3	3.6	-2.2	1.1	-5.6	-0.9	-5.5	5.9	-4.1	-8.0	-5.0
total net flows	11.0	-2.8	5.9	10.9	5.0	2.6	11.1	-6.4	-57.7	33.7	-0.3

Source: Bank of Korea (BOP base).

Graph 2
Trends of Capital Flows in Korea

Source: Bank of Korea (BOP base).

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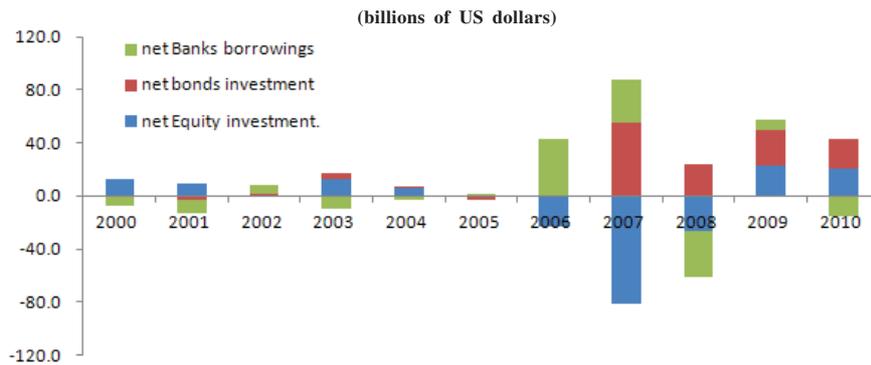
2.1.1 Prior to the Lehman Collapse

Prior to the Lehman collapse, the main items of net capital inflows to Korea were bank borrowings of Korean banks including foreign bank branches and bond investments of foreigners, while equities investment of foreigners registered capital outflows from 2005 to 2008 (Table 1). This fact implies that the capital flows into and out of Korea are very vulnerable to external shocks and that there is a high possibility of quick capital outflows in times of financial turmoil (Ahn, 2008).

Since 2006, the sharp increase in capital inflows of banking borrowings were very closely related to that of Korean bond investment (Yang and Lee, 2008, Baba and Shim, 2010). With the expectation of dollar depreciations since 2006, Korean shipbuilders and other exporting firms as well as Korean investors in foreign stocks sold a huge amount of US dollar forwards to domestic banks to hedge their dollar exposures. Korean domestic banks bought these US dollar forwards and exposed to dollar over-bought positions. They had to borrow US dollars from foreign bank branches or off-shore international banks in order to make a dollar square position and hedge dollar over-bought position in forwards. There were two methods of borrowing US dollars: one is outright bank borrowings from international banks, and the other is swap borrowings from the foreign exchange market in Korea.

The Korean domestic banks mainly depended on the short-term FX swap borrowings from foreign banks branches in FX market. The latter funded US dollars from their headquarters at low costs and, in turn, invested in Korean Treasury and Bank of Korea bonds with the Korean Won they had acquired from swaps.

As the result of these transactions, the external debts of domestic banks and foreign banks branches increased rapidly from 2006 to 2007 (Graph 3). The strong demand for FX swap borrowings pushed down the FX swap rate below the interest rate differential between the United States and Korea. In effect, deviations from covered interest parity (CIP) widened sharply after the mid-2007. However, the foreign banks branches did not actively take advantage of the enlarged arbitrage opportunities, but began to decrease their investments in Korean bonds so that their headquarters withdrew their liquidities.

2.1.2 After the Lehman Collapse

After the collapse of Lehman Brothers in September 2008, the financial and foreign exchange markets in Korea were thrown into turmoil. Under the shock of the international financial market and deleveraging of international banks, the Korean won (KRW) and the Korean CDS premium (5Y) began to plummet because of outflows of foreign investment funds and deterioration of foreign currency borrowing conditions.

With the deepening of the international financial market unrest, net capital outflows from Korea have continued and foreigners' net selling of Korean stocks has continued in the stock market. In spite of the markedly expanded incentives for arbitrage trading, foreign bond investment funds and foreign bank branches fled from the bond market. In the process of the global financial institutions' rapid and sharp deleveraging, the large international banks reduced their exposures to Korea and the foreign bank branches diminished their off-shore borrowings and supplying of US dollars through swaps in the FX market. The Korean domestic banks faced the difficulty of dollar funding from the international banking market and the on-shore swap market, which was already strained by the unwinding of foreign bank branches.

In response to the rapid capital outflow and dollar liquidity dry-up, the Korean policy authorities took counter-measures and implemented new macro-prudential policy instruments to stabilise the financial and foreign exchange markets and strengthen the macro-prudential of the Korean economy.

Graph 3
Trends of Bank's External Borrowings
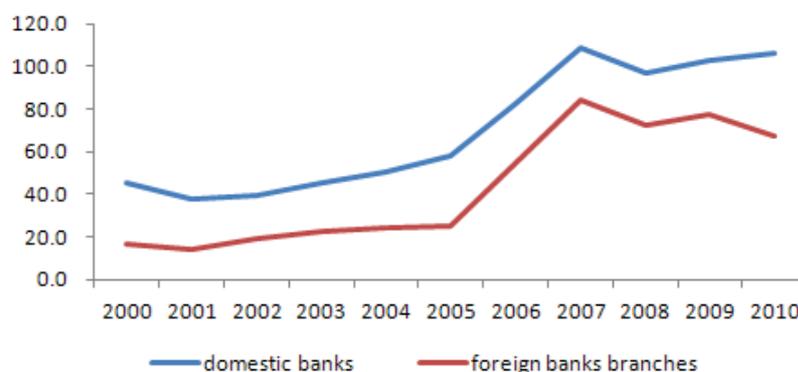
Source: Bank of Korea.

Graph 4
CIP Deviations in the Korean Three-month FX Swap Market
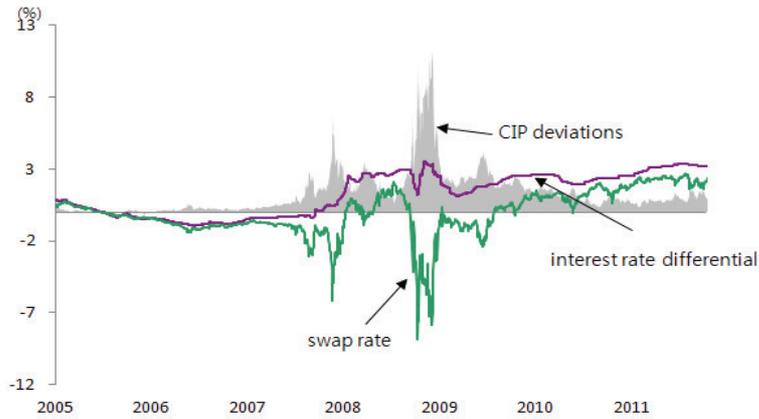
Source: Bank of Korea.

Graph 5
Exchange Rate and CDS Premium
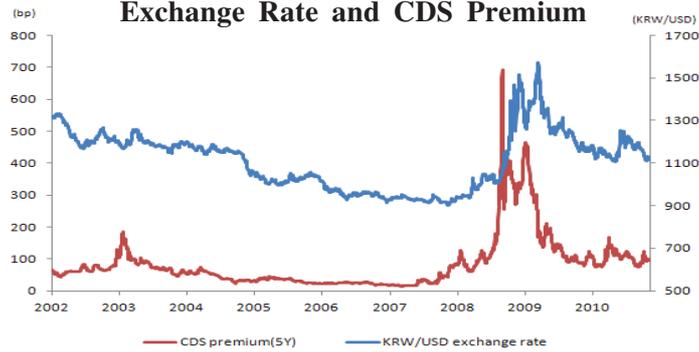
Source: Bloomberg.

2.2 Implementation of New Macro-prudential Policy Instruments

2.2.1 Policy Response to Stabilise the Foreign Exchange Market

During the global financial crisis, the Bank of Korea and the Korean government swiftly widened the FX liquidity to stabilise the FX market (BOK, 2009, Ahn, 2008). The BOK entered into a US$30 billion swap agreement with the US Federal Reserve to strengthen the backstop, thereby blocking the risk

of the global financial market turmoil spreading into the domestic economy in October 2008. Additionally, the BOK not only entered into a 180 billion yuan/ 38 trillion won swap arrangement with the People's Bank of China, but also expanded the ceiling of an existing currency arrangement with the Bank of Japan from US$3 billion equivalent to US$20 billion equivalent to strengthen regional cooperation in the face of the global crisis. These announcements reversed the market sentiment and helped Korea overcome the financial turmoil more quickly than most other countries.

Table 2
Currency Swap Arrangements between
the BoK and Other Central Banks

	US Federal Reserve	People's Bank of China	Bank of Japan
Ceiling	USD 30 billion	180 billion yuan	USD 20 billion equivalent
Date of announcement	30 October 2008	12 December 2008	12 December 2008
Expiry date	1 February 2010[1]	3 years	1 February 2010[2]

Source: Bank of Korea.

The BOK also provided a total of US$26.6 billion in foreign currency liquidity to banks suffering from difficulties in overseas funding. Approximately US$10 billion from the BOK's foreign reserves were provided to the swap market by way of competitive auction to resolve the swap market liquidity shortage. In addition, a cumulative US$16.4 billion was supplied through the competitive auction loan facility using the proceeds of currency swaps with the US Federal Reserve. Besides these facilities, the BOK introduced the Foreign Currency Loans Secured by Export Bills Purchased scheme in order to provide incentives to banks to be active in handling trade financing for SMEs. These funds were used efficiently for roll-over of banks' short-term borrowings including FX swaps, worked as a liquidity backstop preventing the worsening of overseas funding conditions.

Table 3
Bank of Korea Foreign Currency Liquidity Supply

	Plan	Supply	Period (numbers)
Competitive auction Swap facility	10	10.3	21 October to 16 December 2008 (7 occasions)
Competitive auction Loan facility	30[1]	16.3	2 December 2008 to 20 January 2009 (5 occasions)
Foreign currency loans secured by export bills	10	0.2	10 December 2008 to 25 February 2009 (7 occasions)
Total	50	26.8	

[1] The ceiling for the swap arrangement between the BoK and the US Federal Reserve.

Source: Bank of Korea.

2.2.2 Implementation of New Macro-prudential Policy Instruments

As the global financial crisis has been alleviated, the advanced economies have implemented quantitative easing policies, which have expanded the amount of global liquidity. Emerging economies' sound economic fundamentals and other factors have resulted in capital inflows into their markets. Consequently, large portfolio investment in Korea has resumed in equity and bond markets, while bank borrowings have increased only slightly. The source of capital inflows has diversified to include Asian countries as well.

Procyclicality of capital flows, namely massive capital inflows during booms turn to abrupt and massive outflows when the external shock outbreak, was the main factor contributing to financial and macro-prudential instability in Korea. The excessive volatility of capital flows resulted largely from the openness of the financial markets. In addition, the need to introduce macro-prudential measures to reduce systemic risk by mitigating excessive volatility of capital flows has increased and the international consensus regarding this issue has rapidly grown.

In June 2010, the Bank of Korea and the Korean government announced the implementation of 'new macro-prudential measures to mitigate volatility of capital flows' (Press Release, 2010). The stated goal of these measures was to reduce volatility arising from shifts in banks' access to short-term external funding sources. The announced measures include 'ceilings on foreign exchange derivatives positions of banks', 'restoration of the tax on foreigners' bond investment', and 'macro-prudential stability levy'.

2.2.2.1 Ceilings on FX Forward Positions

Prior to the global financial crisis, FX forward transactions of exporters, particularly shipbuilders, with banks were the main factor in the surge of short-term external debt through foreign bank branches. Responding to Korean corporations' over-hedging, domestic banks should borrow dollars from foreign bank branches with FX swap transactions, cross currency swaps or banking borrowings. Although these FX derivatives including forwards, swaps and NDFs among banks and corporations resulted in rapid increase in short-term external borrowing, which accounted for about half of the increase in the total external debt during 2006-2007, there were no rules or regulations on FX derivatives.

The government introduced new limits on the FX derivatives positions including all sorts of currency derivatives of domestic banks and foreign bank branches to manage over expansions of short-term external debts. The ceiling on FX derivatives position was set at 50% of equity capitals for domestic banks at the end of the previous month, and at 250% for foreign bank branches. The ceiling could be adjusted on a quarterly basis in accordance with economic conditions, the market situation, and the impact on business activities. To take precautions against the European banks' deleveraging from the European fiscal crisis, the ceilings on including positions were lowered in May 2011, from 50% to 40% for Korean domestic banks, and from 250% to 200% for foreign bank branches.

Since the ceiling on FX derivatives position was introduced, the FX overbought position of foreign bank branches has been reduced considerably, leading to a sizeable decrease in short-term external debts. There seems to be no significant negative effect on FX market despite the initial concerns about a worsening of foreign currency liquidity conditions.

2.2.2.2 Restoration of the Tax on Foreigners' Bond Investment

In May 2009, Korea abolished the 14% withholding tax on interest income and 20% tax on capital gains earned by foreign investors on Korean Treasury Bonds (KTBs) and Monetary Stabilisation Bonds (MSBs). It should be noted that tax benefits for foreign investors also contributed to the surge in capital inflows. Excess inflows could make both the bond market and the foreign exchange market more volatile, leading to an enlargement of systemic risk for the economy as a whole.

The government amended the Personal Income Tax Law and Corporate Tax Law to restore the tax on foreigners' capital gains and interest income from KTBs and MSBs on 7 December 2010. Taxation on interest income and transfer gains (re-introducing withholding taxes of 14% and 20%, respectively) from foreign holdings of domestic bonds was charged in order to deal with increased number of foreign and domestic investors while applying flexible tax rates (adjustable down to a zero-rating) when urgently needed.

The restoration of the tax is expected to reduce the systemic risk of the Korean economy by curbing short-term capital inflows and moderating financial market volatility. Specifically, the bond market will not be affected by this measure because long-term capital inflows will continue based on Korea's sound economic fundamentals. It will act to moderate the surge in capital flows, which will reduce exchange rate volatility and eliminate the factors related to foreign exchange market unrest. In addition, this measure does not represent an imposition of capital control but aims to provide equal conditions to bond investments of residents and non-residents.

2.2.2.3 Macro-prudential Stability Levy

The introduction of the financial levy is consistent with the global trend. Developed countries like US, the UK, Germany and France, members of the G-20 countries, have also discussed the necessities of imposing financial levy on financial transactions with the goal of repairing the financial system or banks' resolutions.

Under this global trend, the Korean government and the Bank of Korea introduced 'Macro-prudential Stability Levy' (the Levy) on the balance of banks' non-deposit foreign currency liabilities in the latter half of 2011. There are several considerations in introducing the Levy with the view of Korean financial and foreign exchange market conditions.

First, the Levy is imposed on the balance of banks' non-deposit foreign currency liabilities to enhance macro-prudential by moderating the excessive volatility of capital flows. The volatility of capital flows, excess capital inflows during boom periods and sudden capital outflow from external shocks, was a major factor of the past FX liquidity turmoil in Korea. However, foreign currency deposits are exempt from the Levy because foreign currency deposits are covered by the deposit insurance system. The Levy differs from a financial transaction tax (Tobin tax) in that a Tobin tax is imposed on non-residents' bond and equity investment. Second, it is expected that the levy will contribute to decreasing

banks' short-term foreign currency borrowings and improving the quality of Korea's external debts by increasing long-term debts. Lastly, by setting aside the proceeds of the Levy and using them as an instrument for supplying FX liquidity in a crisis, the Korean economy's capacity for handling external shocks will be improved.

The Levy rates are differentiated in accordance with maturity: 20bp for short-term (below 1 year) debts, 10bp for mid-term (1-3 years) debts and 5bp for long-term (over 5 years) debts.

3. Assessing Systemic Risk of Major Banks in Korea

3.1 Systemic Risk of Korean Banks

The financial stability analysis department of the Bank of Korea developed a financial system stress test model (BOKST-07) at the end of 2007, and assessed the stability of the financial system by comparing changes in the levels of risks facing Korean banks in the aftermath of shocks caused by changes in their BASEL II BIS capital ratios (BOK, 2008).

The credit risk stress testing model consists of: (1) a probability of default (PD) estimation model, for determining the relationship between the macroeconomic variables and the PD, and (2) a credit risk estimation model, employing the Foundation Internal Ratings Based (FIRB) approach of BASEL II and using the estimated PDs as input variables (Figure 1). Using the market risk stress testing model, changes in mark-to-market asset value in response to the different scenarios were calculated for each asset type. Market VAR corresponding to each stress scenario was also calculated, to estimate capital requirements (Figure 2).

The stress test conducted by using BOKST-07 shows that Korean banks' BIS capital ratio would not fall below 8% with most profitability indicators retaining positive values even under stressed macroeconomic scenarios, such as shocks of interest rate, equity price, exchange rate, property price, oil price and global economy-related shocks.

Therefore, the capacity of the Korean banking system regarding internal loss absorption in the event of an external shock appeared sound. This result owed, in great part, to the improved capital adequacy and profitability of Korean banks following the restructuring since the financial crisis in 1997.

Figure 1

PD estimation model

Corporate model

$$\ln\left(\frac{PD_{i,t}}{1-PD_{i,t}}\right) = -4.71 - 6.95GDP_{t-2} + 6.79RCB_{t-1} + 3.25ULC_t - 1.89NBTT_{t-1}, \quad R^2 = 0.69$$

SME corp. model

$$\ln\left(\frac{PD_{i,t}}{1-PD_{i,t}}\right) = -3.45 - 4.18GDP_{t-3} + 9.78RCB_{t-2} + 5.91ULC_t - 7.77Lf_t, \quad R^2 = 0.93$$

Retail model

$$\ln\left(\frac{PD_{i,t}}{1-PD_{i,t}}\right) = -3.68 + 5.09(UR+CPI-GDP)_{t-3} + 13.72RCB_{t-3} - 3.30WE_{t-2}, \quad R^2 = 0.75$$

Notes: 1) All estimated coefficients were statistically significant at 90% confidence or more.
2) Percentage changes in macroeconomic variables, exclusive of rates of return on corporate bonds and unemployment rates, from the corresponding periods of the previous years

* Variable List
PD : Probability of default; GDP : Gross domestic product; RCB : Rate of return on corporate bonds; ULC : Unit labor cost
NBTT : Net barter terms of trade; UR : Unemployment rate; CPI : Consumer price index; WE : Total household assets
Lf : Liquidity of financial institutions

Credit VaR

Probability

EL   UL

Confidence Level
(99.9%)

0   Average loss under normal conditions   Maximum loss under normal conditions(VaR1)   Maximum loss under stress conditions(VaR2)   Loss

Market $VaR = W\Gamma\sigma\sqrt{\tau}$

Note: W : exposure, Γ : confidence level (99%)
σ : volatility, τ : holding period (10 days)

Recently, the BOK has collaborated with the IMF to assess the interconnectedness across Korean banks using three alternative methodologies (Aydin, et al., 2011). The interconnections between banks become a powerful channel for the transmission of financial shocks to the real economy and underscore the importance of common exposures of financial institutions to each other as a key step in maintaining the overall stability.

Three different methodologies are adopted to quantify risks based on financial interconnectedness of Korean banks. These methodologies are the network, co-risk and distress dependence approaches. The findings indicate that Korean banks are interconnected. However, there appears to be no bank that by itself poses systemic threats to the rest of the system, and no bank is highly vulnerable to distress in another bank. Moreover, the analysis suggests both the financial risks that banks pose and the contagion risk that they create have declined significantly in the aftermath of the global financial crisis.

The network approach measures the financial exposures that banks create on one other by analysing the bank balance sheet data focusing on credit risks and funding losses. The results of this analysis indicate that no single default of Korean banks generates significant distress on other banks in the system.

The co-risk model estimates the rise in the default probability of a bank based on the default probability of other banks in the system. The findings of this methodology indicate that major international financial events, such as the bankruptcy of Lehman Brothers, were the main factors moving the conditional default probability of Korean banks. Domestic events caused relatively few changes in the conditional default probabilities, indicating that Korean banks' high degree of integration to the global financial markets is a more important source of distress.

The distress dependence approach helps us quantify the level of distress that a bank, or a group of banks, can pose on another bank in the system or to the whole system. The results indicate that the systemic risks that a bank can pose to the whole system are limited.

3.2 Estimating Korean Banking Risks using Contingent Claims Approach

The Contingent Claims Approach (CCA) is a structural model based on the Black-Scholes and Merton model. In the theoretical concept, it is shown that the Black-Scholes and Merton model can be applied to calculating risks in the financial system by showing the distance of institutions from the default barrier and estimating the probability of the default (Lewis, 2010, Gray, 2008).

The value of the firm's liabilities is considered as a default barrier. The distance to default is a function of the growth in a firm's asset, the difference between the market value of a firm and the default barrier and the volatility of a firm's asset. The distance to default (d2) measures the number of standard deviation from the mean before a firm's assets falls below the default barrier. The distance to default could be converted into a probability of default using the cumulative normal distribution (Figure 3).

Figure 3
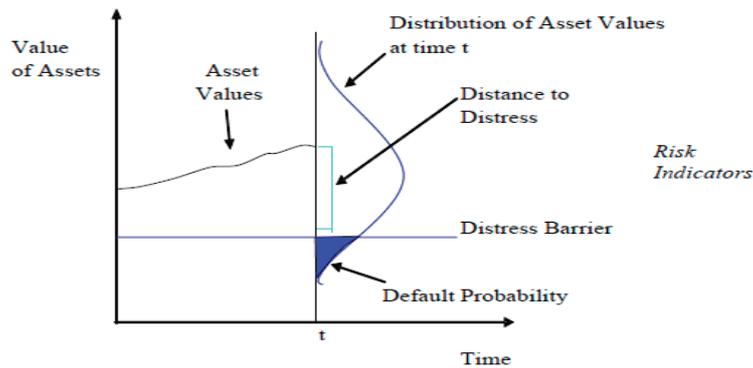
$$d_2^* = \frac{LN\left(\frac{V_0}{DB}\right)+\left(\mu-\frac{\sigma_D^2}{2}\right)T}{\sigma\sqrt{T}} \qquad Probability\ of\ Insolvency = N\left(-\frac{LN\left(\frac{V_0}{DB}\right)+\left(\mu-\frac{\sigma_D^2}{2}\right)T}{\sigma\sqrt{T}}\right)$$

The Korean banking sector risks covering the five largest commercial banks are assessed by the CCA model as suggested by a project leader of the joint research. Compared to the above mentioned risk models, the default risk of large banks in Korea measured based on the distance to distress and default

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probability has been increasing more or less since global financial turmoil in 2007 (see Figure 4). This trend shows the increasing volatility of banking assets and stock prices of banks in the capital market after the European fiscal crisis because the asset volatility and the stock prices are the key factors to determine the banks' probability of defaults.

In spite of the enhanced soundness of loans and capacity of absorbing losses of Korean bank, the recent NPL ratios of banks stand at 0.6%, and the BIS and Tier I capital ratios of banks at 14.5% and 11.4%, respectively, much better than the international standards and banks of major countries. Some risk factors to asset quality and volatility still remain in Korean banks (FSR, 2011). With the continuous stagnation of home prices in Seoul, coupled with the already high level of household debt, the risk of worsening household loans is on the rise. On the corporate side, credit risks mainly among SMEs, which cannot cover their interest expenses with operating income, could also increase under continuous uncertainties in the world economy and any deterioration in business conditions due to unexpected internal or external shocks.

Figure 4

Banking Sector
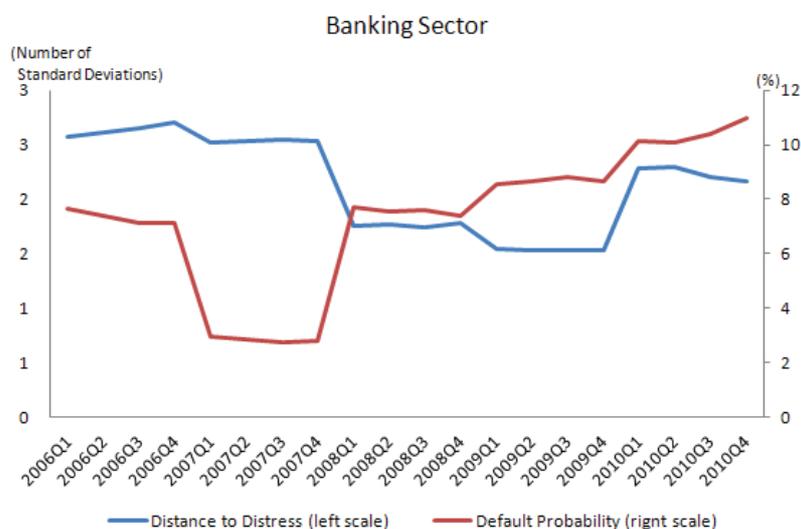
4. Concluding Remarks

The Korean economy has shown a robust expansion since the second half of 2010 backed by the rapid recovery from the global financial crisis, and the overall banking system is adequately capitalised with improvements in the soundness of their asset (IMF, 2011, BOK, 2011). However, the recent financial crisis and the European fiscal crisis have demonstrated that strong economic fundamentals and micro soundness of banks could not guarantee the insulation of an economy from all possible external or internal shocks.

The reason why we implemented the new macro-prudential policy instruments is to safeguard the Korean economy against unexpected external shocks. The limits on foreign currency derivatives have contributed to the maintenance of banks' short-term debt below pre-crisis levels, although it could be controversial whether or not the reinstatement of the withholding tax and the new implementation of the Levy would be effective in curbing the volatility of capital flows (IMF, 2011). The systemic risks of the major Korean banks which were assessed based on the stress test model (BOKST-07) and financial linkage models (BOK and IMF) are limited and manageable. However, the results of CCA models call for attention to more careful monitoring of the risk factors of Korean banks, such as the growth of household and small-sized enterprise debts, asset quality and asset volatility of banks.

The systemic risk model mentioned in this report should be also continuously improved to increase the model's precision and practical relevance. To achieve more accurate measurement of risk levels, systemic risk models to take into account the characteristics of individual financial transactions, including FX derivatives, FX borrowings and loans.

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Chapter 5

A MACRO-PRUDENTIAL ASSESSMENT FOR MYANMAR

By
Win Hteik[1]

1. Introduction

The financial sector of a country can drive and accelerate the economic growth. Financial instability can destroy the economic growth of the country. Other countries can also be impacted in the process. Most of the crises stemmed from weakness in the financial sector and they give rise to economic recessions around the world. The recent financial crisis has highlighted the need to go beyond a purely micro-based approach to financial regulation and supervision. There is a growing consensus among policymakers that a macro-prudential approach to regulation and supervision should be adopted.

Therefore, we should maintain the stability, soundness and sustainable growth of the financial sector. For that purpose, macro-prudential policies become the key issues for countries. Macro-prudential indicators can be defined as indicators of the health and stability of the financial system.

In the past, the regional and global financial crises did not pose any challenges for Myanmar because its financial sector has not been fully integrated into the world's financial markets. With the formation of the new government in 2010, Myanmar initiated many reforms in the economic and financial sector to stimulate economic development. Therefore, Myanmar needs to maintain stability in the financial sector in line with the growing economy.

Regarding banking regulations, most countries of ASEAN conform to the international standards set in the framework of Basel Committee of Banking Supervision, notably Basel II. In some countries, their soundness indicators follow CAMELS. In order to maintain the stability, soundness and sustainable growth of its financial sector, Myanmar has adopted the CAMEL framework.

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This paper outlines the financial sector of Myanmar and examines the supervisory and regulatory framework of the banking sector in Myanmar. Following the introduction, Section 2 analyses the background of the Myanmar economy. Then, Section 3 traces the financial sector development in Myanmar. Section 4 describes the elements of the macro-prudential policy framework. Section 5 covers the analysis of Private Banks in Myanmar. Section 6 presents the findings of the soundness of the Private Banks. The conclusion follows with some suggestions for the improvement of the framework for macro-prudential policies in Myanmar.

2. Background on the Myanmar Economy

2.1 Background

Myanmar is the largest country in mainland Southeast Asia with a total land area of 676,577 sq.km. (261,228 sq.miles.) sharing total international borders of 5,858 km (3,640 miles) with Bangladesh and India on the north-west, China on the north-east and Laos and Thailand on the south-east. It has a total coastline of 2,276 km (1,414 miles).

Three parallel chains of mountain ranges run from north to south in Myanmar, namely, the Western Yoma or Rakhine Yoma, the Bago Yoma and the Shan Plateau. The peak of the Hkakabo Razi at 5,881 meters is the highest in Southeast Asia.

These mountain chains divide the country into three river systems, the Ayeyarwady, the Sittaung and the Thanlwin. The Ayeyarwady, the most important river about 2,170 km. (1,350 miles) long, and its major tributary, the Chindwin, 960 km. (600 miles), constitute the greatest riverine system in the country. As it enters the sea, the Ayeyarwady forms a vast delta of 240 km. (150 miles) by 210 km. (130 miles).

As Myanmar is mainly in the Tropical Region, it has a tropical monsoon climate with three seasons: the hot season from mid-February to mid-May, the rainy season from mid-May to mid-October and the cool season from mid-October to mid-February. Annual rainfalls vary from 500 cm in the coastal regions to 75 cm and less in the central dry zone. Mean temperature ranges from 32° c in the coastal and delta areas and 21° c in the North Lowlands. During the hot season, temperature can run considerably high in the central dry zone.

Myanmar's population, spread over seven states and seven divisions, is estimated at over 40 million in 1996-97, an increase of 1.85% over the previous year. Myanmar is inhabited by many ethnic nationalities. The Bamars form the largest group comprising about 68.96% of the population. They live mainly in the lowlands. Other nationalities live mainly in the seven states. About 89.4% of the population comprising mainly Bamars, Shans, Mons, Rakhines and some Kayins are Buddhists, while the rest are Christians, Muslims and Hindus.

There are many ethnic groups living together and they have their own costumes, customs and festivals. About 89.4% of the population are Buddhists.

Agriculture is the mainstay of the Myanmar economy. This sector accounts for much of the income and employment in the country. About 60% of GDP comes from agriculture and as much as 65% of the labour force is employed in this sector alone.

2.2 Overview of Economic Development

Myanmar gained its independence on January 4, 1948, and adopted a market economic system until 1962. However, a complete change in the political system transformed Myanmar's economy into a centrally planned economic system in March 1962. The State Law and Order Restoration Council (SLORC) assumed political power in September 1988 and the centrally planned economic system was officially abandoned. Myanmar was redirected towards a market-oriented economic system once again.

The financial, industrial and foreign trade sectors came under the complete control of the state under the socialist economic system. Even in domestic trade, the state and cooperative sector played a dominant role. However, during the transition to a market economy, the private sector has been given an opportunity to engage extensively in the various sectors of the economy. Since the 1988 policy change, the government has been carrying out economic reforms in various areas so as to strive for economic development based on a market economy. In implementing these economic reforms, Myanmar renews its target and has been carrying out reforms ranging from fiscal and financial affairs to state-owned enterprises.

Due to a deterioration of economic conditions since the mid-1980, economic reforms have been introduced to encourage foreign direct investment, promote exports, and encourage the development of the private and cooperative sectors

while evolving a market-oriented economic structure. Moreover, the government removed the laws, orders, rules, regulations, and notifications, which have prohibited or restricted private sector participation in economic activities and replaced them with new legal instruments giving the private sector, including foreign investors, the opportunity to do business and make investments. Participation by the private sector in the economy has increased significantly with the implementation of these reform measures.

However, Myanmar did not achieve significant growth in GDP in the period after starting the reforms. The growth rate in 1988/89 Fiscal Year (FY)[2] fell significantly to 11.4%, followed by 3.7% in 1989/90, 2.8% in 1990/91, and negative growth again in 1991/92. Although many reforms were carried out during this period, significant change has not yet been achieved.

The Myanmar government formulated a short-term "Four-Year Plan" (for the fiscal period 1992/93 to 1995/96) as soon as economic stability was restored, with a view of enhancing production, particularly in agriculture and export promotion. Implementation of the short-term plan was completed with remarkable success in all four years, attaining an annual growth rate of 7% compared with the target of 6%. This result was achieved through the efforts to obtain high levels of investment from development programmes and also through a doubling in the value of exports. Moreover, Myanmar has seen an improvement in investment at an average annual rate of 30%, of which more than 50% was underwritten by the private sector, including foreign direct investment.

After the short-term four-year plan, the government continued to implement a further five-year plan, for the fiscal period 1996/97 to the 2000/01. The main objective of the short-term five-year plan is the creation of a more diversified structure conducive to the emergence of a modern market economy. Hence, while the shares of mining, processing and manufacturing sectors are expected to improve, the share of the agriculture sector in total GDP is projected to decline. However, the economy slowed down after the introduction of the "Five-Year Plan", because of sluggish agricultural production and the negative effect of the Asia financial crisis.

In 1996/97, the first year of the Five-Year Plan, the annual GDP growth rate decreased to 6.4% compared with annual growth rate of 6.9% in 1995/96. After the first Five-year plan, the government implemented another short-term Five-year plan and the average annual growth rate achieved 10%.

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2. Fiscal Year (FY) runs from the beginning of April to the end of March.

The agricultural, livestock, fishery and forestry sectors are the main contributors to GDP with the share of about 38%, followed by services and other sectors, and industrial sector, respectively.

The Republic of the Union of Myanmar is now implementing its short-term Five-year plan for the period 2011/2012 to 2015/2016 with great momentum in order to maintain the rapid economic growth achieved in the previous years. During 2000/2001 to 2010/2011, the annual growth rate increased to double digit. Figure 1 shows the annual real GDP growth in Myanmar during the fiscal period 2001/2002 to 2010/2011.

Figure 1
Myanmar: GDP Growth Rate
(FY Period 2001/2002 to 2010/2011)
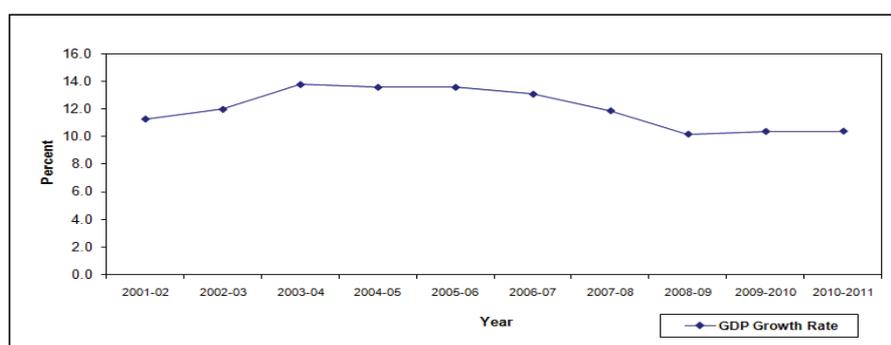
Source: Statistical Year Book, Myanmar and www.csostat.gov.mm

2.2.1 Price Trend

Inflation in Myanmar was over 10% until FY 2008/09. Figure 2 shows the inflation rate during the period 1999/2000 to 2009/2010 in Myanmar. From 2001/2001 to 2008/2009, the inflation stood at over 10%. However, starting from 2009/2010, CPI inflation had fallen below 10%, partly due to indirect impact of the global crisis. The inflation rate measured by the Consumer Price Index (CPI) significantly decreased from 2.40% in FY 2009/2010 to 8.22% in FY 2010/2011. This was due to prudent fiscal and monetary policies and to the decline of global oil prices.

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Figure 2
Myanmar: Inflation Rate (FY 1999/2000 to 2010/2011)
(In Percent)

Inflation Rate

	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Inflation Rate	15.6	-1.72	34.5	58.11	24.94	3.77	10.74	26.33	32.93	29.75	2.24	8.04
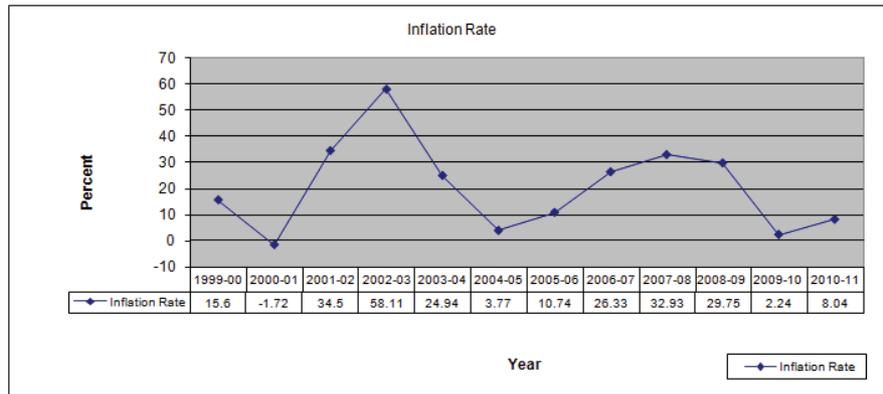
Source: Statistical Year Book, Myanmar and www.csostat.gov.mm

2.2.2 Fiscal Sector

The government placed emphasis on economic and social infrastructure development. This will help create a favourable business environment that is conducive in promoting better economic performance in the coming years.

Looking at the revenue side, various tax reform measures have been undertaken since March 2006. Previously, tax law amendments including changes in tax coverage and tax rates were made by the State Budget Law. The government revenue has been offset by the increase in government expenditure resulting in rising fiscal imbalances.

2.2.3 Monetary Sector

The main objective in formulating monetary policy in Myanmar is to maintain macroeconomic stability in the economy and to promote domestic savings. It is also purposed to promote the efficiency of the payment mechanism, thereby enhancing the conduct of the banking system. Currently, the Central Bank of Myanmar (CBM) uses interest rate policy as its main monetary policy instrument while reserve requirements and open market operations have also been used to a certain extent. The Central Bank rate, as at January 2012, is 10.00% and the maximum interest rate for bank

deposit and maximum interest rate for bank lending are 10.00% and 15.00%, respectively.

In the FY 2010/2011, money supply increased from 33.75% to 37.73% compared to the previous year. This was due to the increase in domestic credit to the private banks.

2.3 Financial Sector Reforms in Myanmar

Financial sector reform is very important for the economic development of Myanmar. Therefore, the Myanmar government is trying to achieve improvement in financial sector development that will support the changing needs of the economy. The financial sector in Myanmar consists essentially of the banking sector and, to a much lesser extent, the non-banking sector comprising insurance business, finance companies and small loan enterprises.

From 1948 to 1962, the financial sector consisted of the Central Bank, state-owned banks, private-owned domestic banks, branches of foreign banks and insurance institutions. Foreign insurance companies made much progress with branches expanding their business three times between 1953 and 1961.

Following the change over to a socialist system in 1963, all the financial institutions were nationalised and restructured into a monolithic bank which discharged both central and commercial banking functions as well as undertaking insurance operations beginning from 1969.

In 1976, the Myanmar government reorganised its financial system, replacing the monolithic banking system with a basic functional system for more effective management of financial activities. Under the new financial system, the Union of Myanmar Bank undertook central banking functions, while the Myanma Foreign Trade Bank took over foreign exchange operations. The Myanma Economic Bank served as a financer of economic enterprises, including those of the state, and the Myanma Agricultural Bank undertook crop financing as well as medium- and long-term lending for agricultural development. The insurance function was separated from the reorganised banking system to be taken over by the newly created Myanmar Insurance Corporation.

In 1988, when Myanmar set out to forge a market-oriented system, the existing financial system based on socialist economic principles was reformed to accommodate the new economic system. In order therefore for the financial sector to assume the appropriate responsibilities, new laws, namely, the Foreign

Investment Law, 1988; the Central Bank of Myanmar Law, 1990; the Financial Institutions of Myanmar Law, 1990; the Myanmar Agricultural and Rural Development Law, 1990; the New Saving Bank Law, 1992; and Myanmar Insurance Law, 1993 were passed.

The CBM Law provides for the Central Bank to aim at attaining objectives that would contribute to the functioning of a soundly based financial system that would foster monetary, credit and financial conditions conducive to orderly, balanced and sustainable economic development. The Financial Institutions of Myanmar Law provides the legal framework for the establishment of financial institutions, whether state-owned or jointly owned by the state and private sectors, to conduct financial activities with the permission of the Central Bank.

Another important reform in the financial sector concerns the deregulation of foreign exchange controls to conserve much needed scare resources. At the same time liberalisation of foreign exchange transactions was carried out. For example, foreign exchange earners from the private sector are permitted to retain their foreign exchange, open foreign accounts and operate them under prescribed conditions. Moreover, the government introduced Foreign Exchange Certificates (FEC) in 1993, with the aim of facilitating the use of foreign exchange by tourists. FECs have become quite popular and even the Myanmar people are making use of them for certain transactions.

While developing its banking sector, Myanmar also implemented some policy measures to develop the domestic capital market. On behalf of the government, the CBM issued 3-year and 5-year Government Treasury Bonds since December 1, 1993, to finance government deficit from savings of the public. Furthermore, in order to develop a bond market in Myanmar and to promote the short-term investment of the public and banks, the CBM introduced a new Government Treasury Bond with 2-year maturity, effective January 1, 2010. Currently, the interest rates on Government Treasury Bonds for 2-year, 3-year and 5-year maturities are 8.75%, 9.00% and 9.50%, respectively.

The Myanmar Securities Exchange Center Ltd. (MSEC), a joint venture firm between the Myanma Economic Bank and the Daiwa Institute of Research Co., Ltd. of Japan (DIR) was formed in June 1996, and it has laid the ground work for the establishment of a capital market.

The Capital Market Development Committee led by the Minister of Finance and Revenue was established on July 1, 2008 in order to facilitate the raising of long-term capital for economic enterprises, companies and

government projects and also to develop a securities market. Moreover, this committee further created six sub-committees on September 17, 2008, to provide support and assistance to the main committee.

In addition, a road map for the development of a capital market is currently being implemented accommodating the time frame for the development of the ASEAN Integrated Capital Market. There are three phases in the implementation of the capital market in Myanmar. The work plan for the first phase has been successfully carried out in the scheduled period of 2008/2009. The second phase will run from 2010 through 2012 and the third phase will be implemented from 2012 to 2015.

3. Financial Sector Development in Myanmar

In Myanmar, the financial system consists of the banking sector and non-banking sector.

3.1 Banking System in Myanmar

The banking system in Myanmar forms the core of its financial system and is the fulcrum of monetary policy. The institutional framework of the banking institutions, along with the CBM, constitutes the monetary system in Myanmar. The basic purpose of the banks is to facilitate the effective mobilisation and allocation of financial resources in the economy in order to help promote economic growth, safeguard stability and raise the living standard of the people.

The banking sector in Myanmar comprises the CBM, four state-owned banks and 19 private banks. The main responsibilities of the CBM are acting as the sole issuer of domestic currency, acting as advisor to the government on economic and financial matters, acting as a banker for the financial institutions, inspecting and supervising the financial institutions, and managing the international reserves of the state.

The state-owned banks include Myanma Economic Bank (MEB), Myanma Foreign trade Bank (MFTB), Myanma Investment and Commercial Bank (MICB) and Myanma Agricultural Development Bank (MADB).

The MEB is the largest state-owned bank and it provides nationwide commercial banking services through its network. The MFTB provides international banking services for the state as well as the co-operative and private sectors. The MICB conducts domestic and foreign banking business serving as

investment and development bank to local and foreign investors, joint venture companies, local and foreign business enterprises. The MADB provides credit to a large network of village banks that act as MADB's agents in channeling loans to the village residents.

The CBM supervises the private banks to oversee they are operating on sound banking principles as prescribed under the Financial Institution of Myanmar Laws, rules and regulations.

The CBM has granted licences for the operation of domestic private banks since May 1993. As at the end of February, 2012, 19 domestic private banks are in operation offering domestic commercial banking services. Some private banks are opening their branches in major cities.

At present, foreign banks are permitted to open only representative offices in Myanmar. As at the end of February, 2012, 16 foreign banks have established representative offices in Myanmar.

The CBM has issued money changer licences to six private banks starting from September, 2011. On November 25, 2011, the CBM has issued Authorised Dealers Licences to 11 private banks to engage in the foreign banking business.

3.2 Banking Policy

The CBM is working on a banking sector development strategy with three phases as follows:

Phase 1 - promoting the institutional development, promoting the skills and efficiency among the domestic banks within the medium term, while allowing foreign banks to open their representative offices in Myanmar.
- Initially foreign banks are allowed to open representative offices which may work only as liaison office of their headquarters.

Phase 2 - permitting selected domestic banks to run joint venture bank with foreign banks

Phase 3 - permitting foreign banks to open bank branches and operate banking activities in Myanmar.

3.3 Non-banking Financial Institutions

In the non-banking sector, there is one state-owned finance company, the Myanma Small Loan Enterprise (MSLE); one private finance company, the Myanmar Oriental Leasing Co., Ltd.; one state-owned insurance enterprise, the Myanma Insurance (MI); one private insurance company, the Myanmar International Insurance Company (MIIC); and four foreign insurance company representative offices. The MSLE was separated from the Myanmar Economic Bank and established as a finance company since August 1992. At present, the MSLE has a network of about 182 branches throughout the country. It facilitates and caters to the financial needs of private individuals and small scale enterprises. A private-owned finance company, namely, the Oriental Leasing Company, has already started its operation since January 1996.

The MI underwrites all types of insurance for companies and individuals with a network of 38 branches. In June 1996, the Insurance Business Law was enacted to promote foreign and local investments and to encourage participation of private entrepreneurs in insurance schemes. Pursuant to this law, four representative offices of foreign insurance companies have been opened. There is also a separate insurance institution, the MIIC, which is owned by the MEC and which began its operation in 1997.

The role of the banking sector is more prominent at the moment. Though the non-banking sector is essential to the economy, it has not yet been developed to a stage to assume responsibilities comparable to that of the banking sector.

4.   Elements of Macro-Prudential Policy Framework

4.1 Supervisory and Regulatory Framework in Myanmar

In Myanmar, the CBM assumes the responsibility for both monetary stability and financial sector stability under to the Central Bank of Myanmar Law, 1990. Regarding the management of financial stability, the CBM uses the CAMEL framework which looks at the six major aspects of a financial institution.

The CAMEL framework is an effective and simple supervisory framework comprising the following components:

C   -   Capital adequacy;

A   -   Asset quality;

M -   Management soundness;

E -   Earnings;

L -   Liquidity; and

S -   Sensitivity to market risk.

The Banking Supervision Department undertakes on-site examination and off-site monitoring. The CBM take regulatory action on the operations of banks by applying the following provisions:

4.1.1 Minimum Reserve Requirement

1. 10% of total deposits is required to be maintained by each bank as the minimum reserve requirement,

2. 75% of the required reserve is to be deposited with the Central Bank and 25% of the reserve may be maintained in the form of cash.

3. Required reserve for a bank to be maintained with the Central Bank must not exceed 35% of the total liabilities of the bank. However, in event of serious inflationary pressure, the Central Bank may increase the 35% ceiling requirement.

4.1.2 Liquidity Control

Banks are required to maintain the level of their liquid assets against their eligible liabilities at not less than 20%.

4.1.3 Capital Adequacy Ratio

The risk weighted assets of a bank shall not exceed ten times the combined total of its capital and reserves.

4.1.4 Legal Lending Limit

Banks shall not lend more than 20% of their capital plus reserves to single individual or to an enterprise of an economic group.

The operations of banks are covered in the following reports which are required to be submitted to the CBM:

1. Weekly   (a)   Weekly Reserve Position
            (b)   Liquidity Ratio
            (c)   Cash in Hand

2. Monthly (a)   Monthly Balance Sheet
            (b)   Income and Expenditure Statement
            (c)   Capital Adequacy Ratio

3. Quarterly - Non-performing Loan Statement

4. Annually - Annual report

The banks are taking appropriate measures to cover the loans as much as possible and the CBM is also issuing banks instructions and guidance on the matter.

All banks are required to build up and maintain general provision account amounting to at least 2% of total outstanding loans and advances as at the end of the year and they are also required to maintain specific provision for doubtful and/or bad loans on a case-by-case basis.

Also, according to the Financial Institutions of Myanmar Law, a bank cannot lend more than 20% of its capital plus reserves to a single individual or to an enterprise of an economic group.

4.2 Current Banking, Regulatory and Supervisory Practices

In order to reinforce the regulatory and supervisory framework and anti-money laundering, the CBM has issued a series of instructions and guidelines for inspection to review bank compliance with AML/CFT requirements according to the Control of Money Laundering Law and Rules enacted in June 2002 and December 2003, respectively.

The CBM has examined all domestic private banks based on the AML/CFT requirements in its regular on-site inspections. It has also conducted special audit programmes for the state-owned banks on the compliance of AML/CFT rules and regulation since September 2004.

Under the guidance of the Central Supervision Committee (CSC), led by the Minister of Finance and Revenue, the CBM is continuously strengthening the supervisory and regulatory controls and taking necessary actions. The CBM also closely monitors the banking activities and encourages banks to be in compliance with international standards and norms.

5. Analysis of Private Banks in Myanmar

In this section, we shall examine the soundness of 19 private banks in Myanmar during the FY period 2003/2004 to 2010/2011. The list of private banks in Myanmar is provided in Appendix A.

5.1 Deposits and Loans

The deposits and loans of Myanmar banks increased during the FY period from 2003/2004 to 2010/2011. The total deposits of the banking sector increased 9 times during the period from March 2004 to March 2011. The total loans of the banking sector increased 6.9 times during the period from March 2004 to March 2011 while the total loan amount of state-owned bank decreased during the period.

Figure 3
State-owned Banks and Private Banks' Deposits and Loans
(FY Period 2003/2004 to 2010/2011)

Source: Central Bank of Myanmar.

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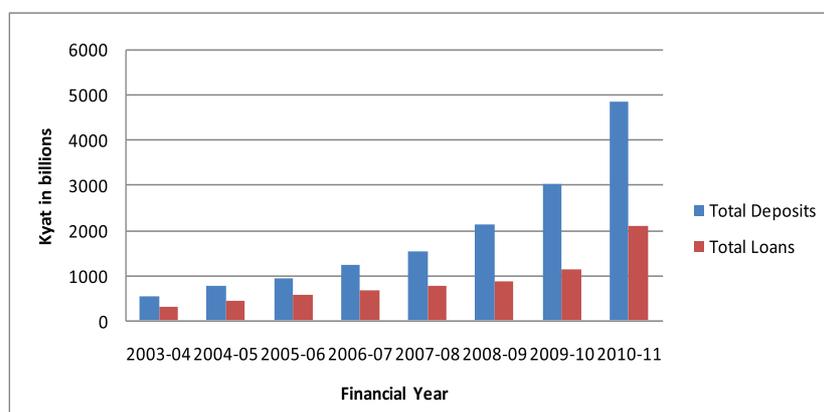
Figure 4 shows the private banks' deposits and loans for the FY period from 2003/2004 to 2010/2011. The growth rate of deposits of private banks increased 15 times and the growth of loans also expanded 18 times during the study period.

Figure 4
Private Banks' Deposits and Loans
(FY Period 2003/2004 to 2010/2011)
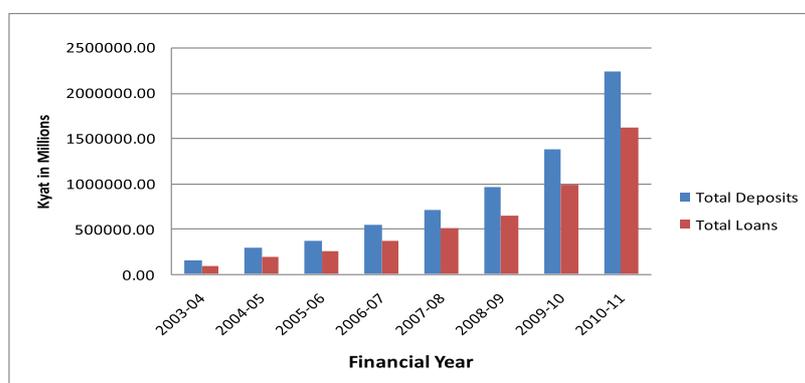
Source: Central Bank of Myanmar.

5.2 Non-performing Loan (NPL) Position

Figure 5 shows the non-performing loans of private banks for the FY period from 2003/2004 to 2010/2011. The dominant business of private banks is domestic banking and the management of credit risk is important for private banks. Therefore, the NPL is a crucial indicator for the soundness of private banks. During the study period, the NPL of private banks were covered by the reserves of these banks.

Figure 5
NPL Position of Private-owned Banks
(FY2003/2004 to 2010/2011)
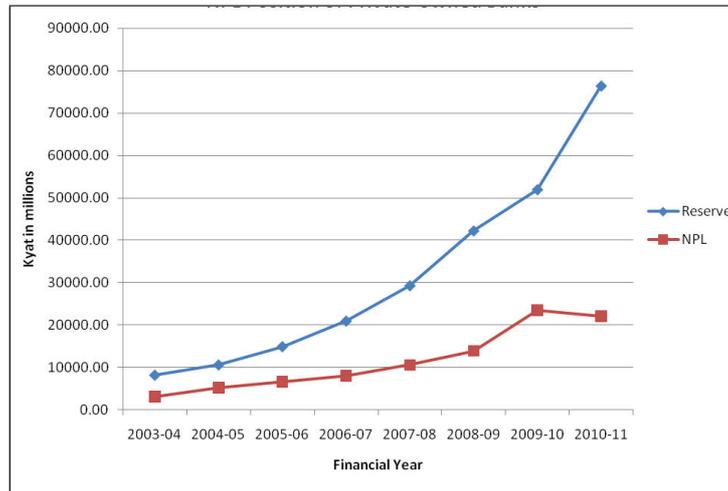
Source: Central Bank of Myanmar.

5.3 Financial Position

Figure 6 shows the financial position of private banks for the FY period from 2003/2004 to 2010/2011. Capital injection is necessary for the soundness of the banks. In Myanmar, the paid-up capital of private banks increased 15 times within 8 years from 2003/04 to 2010/2011.

Figure 6
Financial Position of Private Banks
(FY Period 2003/2004 to 2010/2011)
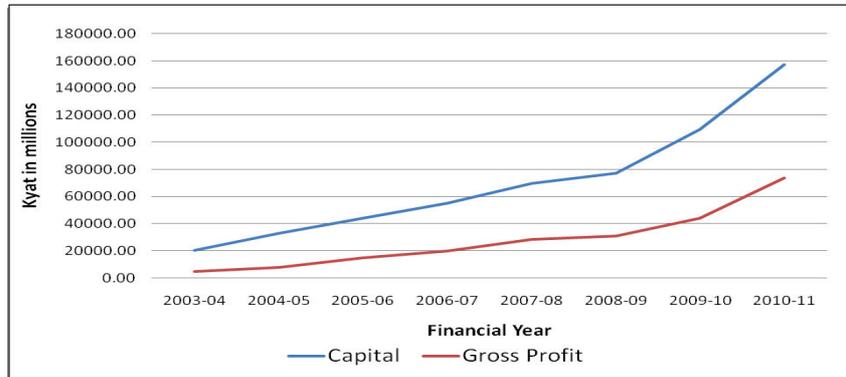
Source: Central Bank of Myanmar.

5.4 Profit Rates of Private Banks

Figure 7 shows the profit rates of private banks for the FY period from 2003/2004 to 2010/2011. The private banks recorded profits every year through the period.

Figure 7
Profit Rates of Private Banks
(FY Period 2003/2004 to 2010/2011)

Source: Central Bank of Myanmar.

93
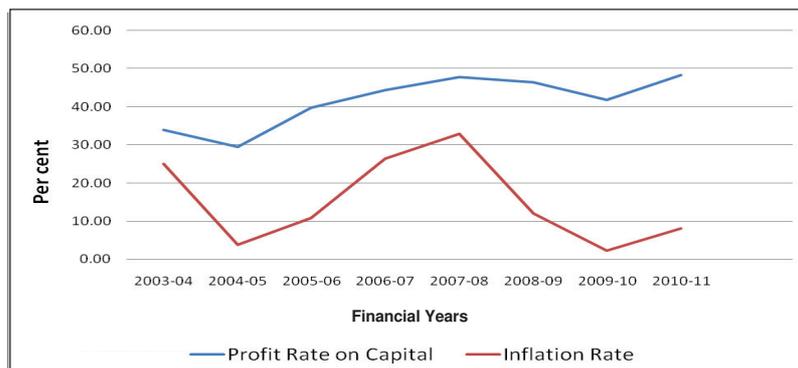
6.   Findings and Discussions

The nature of the state-owned banks and private banks are a little different in Myanmar. Even though the private banks can operate commercially, some state-owned banks are more restricted commercially. For example, the Myanma Economic Bank, the largest of the commercial banks, has to perform commercial banking and the government treasury function. Therefore, we shall only analyse the health and soundness of the private banks.

During the FY period from 2003/2004 to 2010/2011, we find that the paid-up capital of private banks increased by 15 times. The deposits and loans of private banks increased by 15 times and 18 times, respectively.

During the FY period from 2003/2004 to 2010/2011, we find that all the private banks recorded profits every year. Article 11(d) of the Financial Institutions of Myanmar Law, 1990, stipulates that "A financial institution shall aside 25% of its net profits, as prescribed by the Central Bank, in a general reserve account until it reaches 100% of its paid-up capital." Pursuant to this requirement, the general reserve of private banks has increased year by year.

Even though there is some NPL in private banks, their reserves covered their outstanding NPLs.

From the results our study, looking at the FY period from 2003/2004 to 2010/2011, we find that the paid-up capital and deposits and loans of private banks increased every year. In addition, all private banks reported making profits every year. The outstanding NPLs of the private banks are low. Therefore, we can conclude that the health and soundness of the private banks is generally strong.

7. Conclusion

The financial sector plays a vital role in a country's economic development. It is important for the financial sector to be stable. Instability in the financial sector can not only destroy the economic growth of the country, but also its repercussions can impact other countries.

In the past, the global and regional crises did not pose any challenges for Myanmar because the financial sector of Myanmar had not been integrated fully into the world's financial markets.

However, as Myanmar moves forward towards a market economy and its financial sector becomes integrated into the world's financial markets, its financial sector will be exposed and vulnerable to external forces. Myanmar should maintain financial sector stability in line with the growing economy and put into practice banking operation, supervision and regulations that are in line with international practices.

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Abbreviations

ASEAN	Association of Southeast Asian Nations
ATM	Automatic Teller Machines
CBM	Central Bank of Myanmar
CPI	Consumer Price Index
CSC	Central Supervision Committee
FDI	Foreign Direct Investment
FEC	Foreign Exchange Certificates
GDP	Growth Domestic Product
MADB	Myanma Agricultural Development Bank
MEB	Myanma Economic Bank
MEC	Myanma Economic Corporation
MFR	Ministry of Finance and Revenue
MFTB	Myanma Foreign Trade Bank
MI	Myanma Insurance
MICB	Myanma Investment and Commercial Bank
MSEC	Myanma Securities Exchange Center
MSLE	Myanma Small Loan Enterprise
MIIC	Myanma International Insurance Company
SEACEN	The Southeast Asian Central Banks (SEACEN) Research and Training Centre

List of Private Banks

Sr.	Bank Name
1	Yoma Bank Ltd
2	Myanmar Oriental Bank
3	Kanbawza Bank
4	First Private Bank
5	Tun Foundation Bank
6	Asia Yangon Bank
7	Cooperative Bank
8	Innwa Bank
9	Myawaddy Bank
10	Myanmar Industrial Development Bank
11	Myanmar Livestock & Fisheries Development Bank
12	Sibin Tharyar Yay Bank
13	Myanmar Citizen Bank
14	Yangon City Bank
15	Yadanabon Bank
16	Asia Green Development Bank
17	Myanma Apex Bank
18	United Amara Bank Ltd
19	Ayeyarwady Bank Ltd

Chapter 6

A MACRO-PRUDENTIAL ASSESSMENT FOR NEPAL

By
Suman Neupane[1]

1.   Introduction

In the history of modern capitalism, crises are the norm, not exception. That is not to say that all crises are the same. Far from it, the particulars can change from disaster to disaster, and crisis can trace their origins to different problems in different sectors of the economy. Sometimes a crisis originates in the excesses of overleveraged households; at other times financial firms or corporations or even governments are to blame. Moreover, the collateral damage that crisis cause varies greatly; much depends on the scale and appropriateness of government intervention. However, contrary to conventional wisdom, crises are not 'black swan'[2] but 'white swan': the elements of boom and bust are remarkably predictable. (Roubini and Mihm, 2010)

The crises are the accumulated outcome of the sequence of past events as well as their connectedness. Therefore, they can be forecasted if appropriate measures are applied for their calculation. After the global financial crisis of 2008, there is agreement that the conventional models and analytical tools used by central banks and supervisory institutions are not sufficient for identifying the systemic risks of the economy. As there had been a focus mainly on the micro-

2.   The "black-swan" is a metaphor that encapsulates the concept that *the event is a surprise (to the observer) and has a major impact.* After the occurrence of the event, the theories are developed and its causes are identified. It is introduced by Nassim Nicholas Taleb in his book, *The Black Swan*.

prudential regulation to ensure financial stability through adequacy of capital and liquidity of individual financial institutions, it was found insufficient to cope with the system-wide risks. Similarly, the efficacy of monetary policy anchored to the price stability objective is questionable in response to system-wide financial risk.

Financial stability tends to be a common responsibility, reflecting the far reaching consequences of financial crises. It is imperative for coordination across all policies to ensure that systemic risks should be comprehensively addressed. In addition to the monetary policy and micro-prudential policy, the issues of systemic risk can be addressed by macro-prudential policy. Therefore, how to define and develop the macro-prudential element of financial stability policy has attracted particular attention of the policymakers and academia. Policymakers broadly agree that the purpose of macro-prudential policy is to reduce systemic risk, strengthen the financial system against shocks and help it to continue functioning stably without emergency support on the scale that was extended in the crisis. Macro-prudential policy is the measure to prevent the crisis instead of its cure. Therefore, preventative in its orientation, macro-prudential policy is distinct from financial crisis management policy.

The aim of this study is to develop a framework for identifying systemic risk and stress testing of the financial sector and economy of Nepal. The systemic risk is measured as default probabilities of banks. This study uses two consecutive steps: (i) contingent claims analysis (CCA) to evaluate the default probabilities of commercial banks; and (ii) panel vector autoregression (panel-VAR) as macroeconomic model. The CCA approach is used to calculate the time series of default risks. The unrestricted panel-VAR methodology is applied to analyse the impact of macroeconomic shock to default risks.

The CCA is commonly called the Merton Model.[3] The basic analytical tool is the risk-adjusted balance sheet, which shows the sensitivity of the enterprise's assets and liabilities to external "shocks." The CCA framework provides a forward-looking market-based set of indicators to measure the vulnerability of various sectors of the economy and is well-suited to capturing "non-linearities" and to quantifying the effects of asset-liability mismatches within and across institutions. This study uses a new approach to improve the way in which the central bank of Nepal can conduct analysis for the management of the financial

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3. See Merton (1973, 1974, 1977, 1992 and 1998). Initially developed for valuation of corporate firms, CCA has been adapted to financial institutions and sovereigns.

risks of a national economy. In addition, it explores the methodology which is useful for simulations and stress testing to evaluate the potential impact of policies to manage systemic risk of any shocks to the Nepalese economy.

2. Objectives of the Study

The broad objectives of the study are as follows:

- To determine the interrelationships among the macroeconomic and financial stability variables of Nepal;
- To analyse the impact of the shocks on the macroeconomic variables to the financial stability variables of Nepal; and
- To recommend policies regarding financial sector stability of Nepal.

3. Significance of the Study

Nepal Rastra Bank (NRB), the central bank of Nepal, has a major responsibility to maintain confidence in the financial sector in pursuant to the NRB Act, 2002. The objectives of NRB Act, 2002, are the achievement of price, balance of payments (BOP) and securing of financial sector stability. However, its main focus was on inflation. After the global financial crisis in 2008, the NRB, like the other central banks, is focusing increasingly on the financial stability.

Globally, there have been more banking crises in the last two decades than ever before and their consequences have been far-reaching. The NRB, the supervisor of the banks and financial institutions, is also facing the challenges of maintaining financial stability in the country. Effective implementation of New Capital Adequacy Framework and the adoption of more sophisticated approaches are some of the prime concerns of the NRB. The strengthening of supervisory capacity commensurate with increasing number of bank and financial institutions (BFIs) and the movement towards risk-based supervision in the context of increasing risks and tight supervisory resources are the other big challenges to the NRB.

Similarly, the growth of consumer credit, personal loans and multiple banking issues, and difficulty in defining big borrowers are some of the challenges that are hindering prudent lending practices in Nepal. Again, the lack of co-ordination

among various economic sectors, absence of rating agency and the fostering of strong corporate governance in the banking sector are some of the issues to be resolved for the facilitation of sustained development of Nepal's financial sector. In this context, the NRB has the responsibility to ensure financial stability in the country. Therefore, the NRB is encouraging banks for self-regulation and making them sensitive toward risks.

4. Elements of Macro-prudential Policy Framework

The financial crisis revealed critical gaps and weaknesses in the world's financial system and the financial regulatory framework. The explicit incorporation of macro-prudential considerations in the nation's framework for financial oversight represents a major innovation in the literature of financial regulation, which is taking place abroad as well as in Nepal. The new approach to regulation should be constructive and necessary to avoid the likelihood of systemic risk. However, it also poses considerable conceptual and operational challenges in its implementation.

Macro-prudential policy should seek to avoid systemic, or system-wide, financial risk. It must complement the *micro*-prudential policy and coordinate with other types of public policy that have an impact on systemic financial stability.

Macro-prudential Policy Objectives: The analysis of risks from a systemic perspective, not just from the perspective of an individual firm, is the hallmark of macro-prudential regulation and supervision. The objective of macro-prudential supervision and regulation is to lessen the risks of financial disruption that are sufficiently severe to cause significant damage on the entire economy. The systemic orientation of the macro-prudential approach may be contrasted with that of the traditional, or "micro-prudential," approach to regulation and supervision, which is concerned primarily with the safety and soundness of individual institutions, markets, or infrastructures.

Table 1

Comparison of Monetary and Macro-prudential Policy Frameworks

	Monetary Policy	Macro-prudential Policy
Ultimate Target	• Maintaining low and stable inflation	• Preventing the formation and spread of systemic risk so as to reduce the financial crises with large output losses
Indicators for Identifying Risks and Assessing their Intensity	• Inflation Forecast in Relation to Target • Money Supply • Output gap, Indicators of Capacity Utilisation, etc.	• Excessive Debt, Asset Overvaluation, Risk Undervaluation, Liquidity • Property Construction and Trading Activity • Internal and External Balance of Sectors and the Economy • Extent of Leverage Among Institutions and Investors • Asset and Liability Maturity • Currency Mismatch Indicators
Intermediate Targets	• Money Supply • Interest Rates • Exchange Rate	• Resilience and shock-absorbing capacity of the financial system • Amplitude of the financial cycle • Asset price volatility • Level of Uncertainty at Times of Financial Instability
Instruments	• Interest rate • Foreign Exchange Market Interventions • Reserve Requirements • Liquidity • Communication	• Built-in Stabilisers Oriented Towards Creating and Releasing Buffers • Macro-prudentially Applied Supervisory and Regulatory Instruments • Communication

More importantly, defining elements of macro-prudential policy are its *objective*, its *scope of analysis* of the financial system as a whole and its interactions with the real sector; its *set of powers and instruments*, and their *governance as* prudential tools which are assigned to macro-prudential regulatory authorities.

NRB has given both responsibilities of effective implementation of monetary policy and assurance of financial stability in Nepal. Therefore, these two policies should be clearly distinguished. The distinctions between monetary and macro-prudential policies are shown in Table 1.

Macro-prudential regulators must be concerned with at least two types of risks. The first type encompasses aspects of the structure of the financial system - such as gaps in regulatory coverage or the evolution of shadow banking - that pose ongoing risks to financial stability. Secondly, the risks that vary over time with financial or economic circumstances, such as widespread buildups of leverage in good times that could ultimately unwind in destabilising ways.

4.1 Macro-prudential Supervision and Regulation

The regulation and supervision executing a macro-prudential approach to oversight can involve heavier informational requirements and more complex analytic frameworks. In particular, because of the highly interconnected nature of the modern financial system, macro-prudential oversight must be concerned with all major segments of the economy. It must cover financial sector, including financial institutions, markets, and infrastructures. It should emphasise on understanding the complex linkages and interdependencies among institutions and markets, as these linkages determine how any shocks propagate throughout the system.

However, macro-prudential approach should not ignore the need for careful micro-prudential regulation and supervision. The oversight of individual institutions serves many purposes beyond the enhancement of systemic stability, including the protection of the deposit insurance fund, the detection of money laundering and other forms of financial crime, and the prevention of unlawful discrimination or abusive lending practices. Equally important, however, is that micro-prudential oversight also provides the knowledge base on which a more systemic approach must be built; we cannot understand what is going on in the system as a whole without a clear view of developments within key firms and markets. Without a strong micro-prudential framework to underpin them, macro-prudential policies would be ineffective.

The Financial Stability Board, the Basel Committee on Banking Supervision, and other international groups also have undertaken substantial work to coordinate macro-prudential policies in the world. Consistent with the macro-prudential approach, the Basel III framework requires the largest, most globally active banks to hold more, higher-quality capital, reflecting the greater systemic risk associated with financial distress at the largest institutions.

4.2 Macro-prudential Regulation in Nepal

NRB has, continuously, directed its efforts and is making progress in implementing prudential regulations including new capital adequacy norms, strengthening supervisory capacity, making provisions for liquidity support to banks, and introducing Prompt Corrective Actions (PCA), Early Warning Signals (EWS), and Stress Testing of banks. NRB has developed and issued various guidelines on the basis of Basel Core Principles to set the minimum standard for risk management in commercial banks.

The Nepalese banking sector gained momentum after the liberalisation process started in mid-eighties. Rapid growth in terms of the number as well as transactions of the banks and financial institutions has been creating new challenges every year. The number of commercial banks as at the end of 2011 reached to 31 from 5 in 1990. The total assets of the commercial banks increased to Rs 787.11 billion in mid-July 2010 from Rs 26.68 billion in mid-July 1990. In the last decade, a huge change had been observed in the banking practices, banking regulation and supervision. (Bank Supervision Report, 2010)

The NRB has also realised that a stable and reliable financial system is a prerequisite for price stability and stable economic growth. Therefore, the NRB has a responsibility to identify and minimise in advance any major risks that may endanger financial stability. The NRB seeks to maintain confidence in the financial system. In addition to the institution-level micro-prudential analysis, macro-prudential analysis has also become the primary responsibility of the NRB. The aim of macro-prudential analysis is to identify, at a sufficiently early stage, systemic risks threatening the stability of the financial system as a whole.

The financial sector regulation in Nepal, as carried out in the past, also had some macro-prudential aspects, and the recent financial crisis has significantly boarder line implications in "micro" and "macro" prudential theory, however, it is conceptually difficult to demarcate the two in practice. NRB supervises the payment and settlement system infrastructure as a whole by regularly monitoring the liquidity, regularly communicating about the risks and providing guidelines to mitigate risks, and control institutions with strong directives as well. The main elements of macro-prudential regulation of the NRB, though still in the initial stage, are briefly explained below.

Capital Requirements: The Basel Committees on Banking Supervision's (BCBS) recommendations on capital accord are important guiding framework for the regulatory capital requirement to the banking industry of the world.

Realising the significance of capital for ensuring the safety and soundness of the banks and the banking system, at large, the NRB has developed and enforced capital adequacy requirement based on international practices with appropriate level of customisation based on the domestic state of market developments. The simplified Basel II framework that the NRB is using provides capital measurements and capital standards. It is built around three mutually reinforcing pillars, viz. minimum capital requirements, supervisory review process and disclosure requirements.

Table 2	
Minimum Capital Fund to be Maintained Based on the Risk-Weight Assets of Commercial Banks (%)	
Core capital	Capital fund
6.0	10.0

The NRB has prescribed to commercial banks in Nepal capital adequacy requirements that are to be maintained. The minimum core capital of 6% and the capital fund of 10% of risk-weighted assets are to be maintained by the commercial banks. These capital requirement frameworks are higher than the BASEL-II recommendation and international practice.

Risk Management Guidelines to Banks: The NRB (2010) in July issued guidelines to all commercial banks on risk management systems that are required to be in place. This document sets out the minimum standards that shall be expected of a risk management framework. Overall risk management is of utmost importance to banks, and as such, policies and procedures should be endorsed and strictly enforced by the senior management and the board of the bank.[4]

The guideline is a focal point of reference for all requirements of the NRB for overall risk policy formulation and management. The guideline applies to the commercial banks in Nepal. It provides the minimum standard for the risk management practice to be exercised in the banks. A bank may establish a more comprehensive and sophisticated framework than that outlined in the guideline. This is entirely acceptable as long as all the essential elements of the guideline are fully taken into account. This guideline covers the most common risks of Nepalese commercial banks, mainly, Credit Risk, Market Risk, Operational Risk and Liquidity Risk.

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4. Nepal Rastra Bank, Bank Supervision Department, (2010), Nepal Rastra Bank Risk Management Guidelines, July.

Stress Testing Guidelines: The NRB has issued guidelines to Nepali banks for the conduct of stress testing. These guidelines cover simple sensitivity tests in different areas of risk management. There are simple shocks, which provide the minimum standards for stress testing in Nepalese banking. As a minimum, all the commercial banks are required to conduct stress testing at corporate level on a regular basis. The stress test should be conducted in the area of credit, market, operational and liquidity risk. The impact of these should be analysed in the risks of the banks' financial performance.

Liquidity Monitoring and Forecasting Framework*:* The NRB also monitors the liquidity of individual financial institutions as well as the liquidity of the system. The reporting system is based on the systematic framework issued for all financial institutions. The reporting schedule ranges from weekly to monthly reporting requirement. The liquidity monitoring position requirements for Nepalese banks and financial institutions liquid assets is the sum of cash, bank balance, money at calls at short notice, investment in government securities and reverse repo and the placement up to 30 days. Liquid assets should include unencumbered liquid assets only. Unencumbered assets are those assets which are free from any debt obligation and can be easily sold or mortgaged. The report should cover the assets and liability portion as stated in the given format of NRB.

Policy in Real Estates Market: The NRB observed that the main reason behind the rapid growth in real estate sector was due to the massive investment facility provided by the financial institutions. With the view of the bubble in the realty market, the NRB imposed a cap on the exposure of banks and financial institutions to housing and real estate loans, asking them to limit such exposure to 25% of their total investment portfolio. As for the real estate sector, except the housing sector, the NRB has directed the lending banks to reduce exposure to 15% of total loan portfolio by the end of 2011/12 and to 10% by the end of fiscal year 2012/13. Meanwhile, the NRB's directive has been able to control stagnation in the realty business and might have controlled a systemic failure of the financial system.

Deposit Insurance and Others: Developing a financial safety net for banks has been an important issue for the sustainable development of the financial system. The NRB has an objective of promoting stability and credibility of the general public in banking system. Deposit guarantee schemes are recently initiated in the Nepalese financial sector up to Rs. 200,000. In spite of the provision of deposit guarantee, the establishment of the Asset Management Company (AMC),

strengthening of the capacity of the Debt Recovery Tribunal and establishment of Credit Raging Agencies are required in Nepal to maintain and promote financial safety and soundness.

5. Macroeconomic and Financial Indicators of Nepal

Growth and Inflation: Nepalese economy is experiencing a weak performance as indicated by the overall macroeconomic variables. The growth rate of GDP remained at low level at 3.8% over the period 2008 to 2010. However, for the year 2011/12 the Ministry of Finance, Government of Nepal projected the growth rate to remain at 5% as there is a good monsoon which increased the agricultural production. Agriculture is the largest contributor to GDP, making out 35% of the national output. The low level of GDP growth rate is attributed to the low level of gross fixed capital formation.[5]

Figure 1
Economic Growth
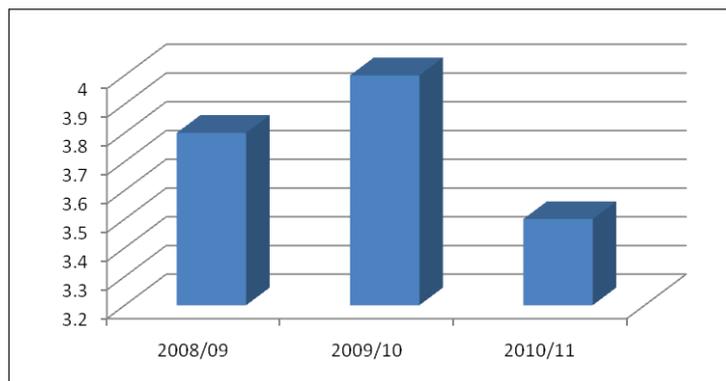
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5. Pandit (2010)

The annual inflation rate, measured as a percentage change in consumer price index (CPI), has averaged 11% over the last three years. It registered the highest rate of 13.2% during the fiscal year 2008/09.

Figure 2
Inflation Rate
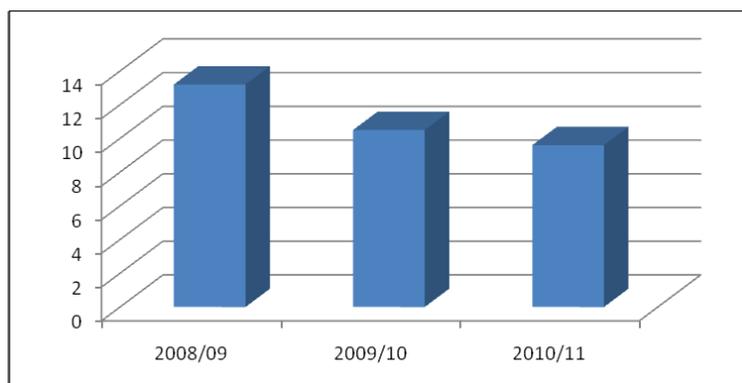
Low economic growth, high inflation, unfavourable balance of payments, high proportion of consumption in GDP, low rate of saving, lack of an investment-friendly environment, energy crisis and weak industrial relationship are some of the challenges facing the Nepalese economy. In this context, the overall business environment signals symptoms of reduced business confidence and weakened investment climate in the economy. Due to these reasons, the various sectors of the economy like agriculture, industry and services are achieving low levels of growth.

It seems that the growth of the banking sector has not yet made a significant impact on the growth of the overall economy. Thus, there is a challenge to channel resources towards productive economic activities for the sustainability of the banking sector and economy as a whole.

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Table 3
Key Macroeconomic Indicators

</div>

Year / Indicators	2008/09	2009/10	2010/11
Economic Growth	3.8	4.0	3.5
Inflation Rate	13.2	10.5	9.6
Per Capita GNI (US$)	471	561	645
Export/GDP (in %)	6.9	5.2	4.9
Import/GDP (in %)	28.8	32.3	28.9
Remittance/GDP (in %)	21.2	19.8	19.3
BoP (in Billion Rs.)	41.28	-3.63	-8*
Budget Deficit/GDP (in %)	5.0	3.5	3.8
Outstanding Debt/GDP (in %)	40.3	34.5	32.0

*However, the balance of payments has been in surplus in the first quarter of 2011/12.
Source: Government of Nepal, MoF, Economic Survey, 2010/11.

As depicted in Table 3, the other variables like export is relatively low in comparison to imports. Remittance, pension and foreign grant are the main contributing factors behind its favourable balance of payments. However, in 2009/10 and 2010/11 the balance of payments remained negative. Due to the negative balance of payment situation, the level of foreign exchange reserve also declined. Similarly, the budget deficit stood less than 5% over the years and the outstanding debt to GDP is 32% in the recent years.

Stock Market: After liberalisation, the Nepali financial system underwent rapid structural changes in the last two and half decades. However, the financial system is basically bank-dominated. Capital markets and stock markets are in the process of development and have not attained full scale operations. The banking institutions, particularly the commercial banks, are the major financial intermediaries in satisfying the financing need of the productive units of the economy.

The overall condition of the securities market has not been satisfactory in the review period of the current fiscal year. As compared to the previous year, the securities market indicators, like the NEPSE indicator, stocks transactions amount, and market capitalisation, have slided down. The NEPSE indicator, which stood at 444.8 points by mid-April 2010, further fell to 373.20 points in the

corresponding period of the current fiscal year. Similarly, the value of capitalised market which stood at Rs. 344.45 billion in mid-April 2010 fell to Rs.331.14 billion by mid-April of 2011. Also, the volume of securities transactions dropped by almost 50% over the review period.

Figure 3
NEPSE Index
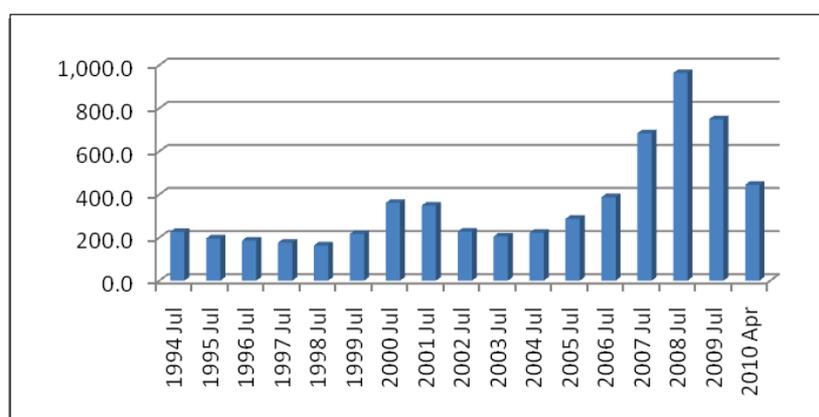
The Nepalese stock market is relatively small, illiquid and thinly traded. Despite the size and illiquid nature of the stock markets, their continued existence and development can have important implications for economic activity (G.C. and Neupane, 2006). Changes in the economy also affect the stock market performance. As the stock market is bank-dominated, the performance indicators of the banks are reflected in the stock markets as well. The Nepali stock market is isolated from the rest of the world. The global economic slowdown has little direct impact on the Nepali stock market. However, as we can see in the above figure, there might have been some psychological effect on the investors.

Non-performing Loan (NPL): The ratio of non-performing loans (NPLs) to total loans declined since 2003/04 to 2.4% from 5.8% for private commercial banks, and from 55.1% to 10.5% for the state banks (IMF, 2010). However, the favourable NPL ratios may be masked by the ever greening of loans and rapid growth of the loan portfolio. The non-performing loan of commercial banks declined to 2.39% in mid-July 2010 from 3.53% in the mid-July 2009. The total amount of NPA remained at Rs. 11,223.34 million from Rs. 13,574.6 million in the mid-July 2009.

Financial Institutions: The Nepalese financial sector is composed of the banking sector and non-banking sector. The banking sector comprises NRB and commercial banks. The non-banking sector includes the financial institutions licenced by NRB, namely, the development banks, finance companies, micro-finance development banks, co-operative financial institutions, and non-governmental organisations (NGOs) performing limited banking activities; and the financial institutions other than licenced by NRB, namely, the insurance companies, Employee's Provident Fund, Citizen Investment Trust, Postal Saving Offices and Nepal Stock Exchange.

Deposit and Credit: The financial sector has expanded in terms of number of institutions. In addition, deposits have also grown significantly. The deposit-GDP ratio which stood at 41.2% in 2003, reached 55.5% in 2009, and it was estimated to remain at 50.8% in 2011. The trend of deposit-GDP ratio is shown in Figure 4.

Figurec 4
Deposit/GDP
(In Percent)
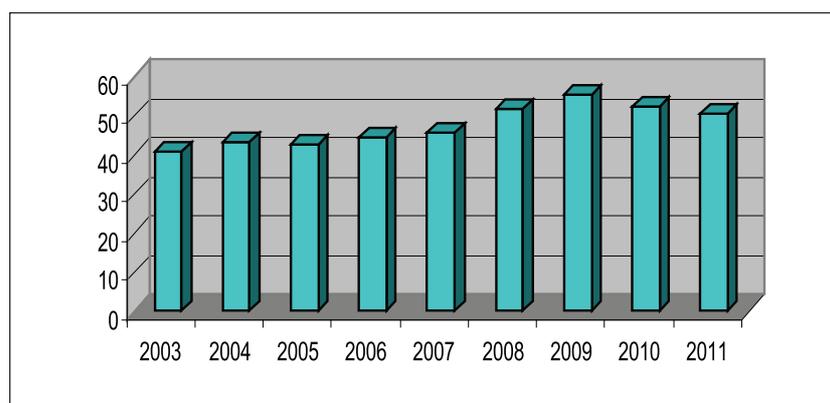
In similar manner, credit advances have also grown significantly in the recent period. The credit-GDP ratio which recorded 45.5% in 2003, reached 56.1% in 2009 and it is estimated to remain at 55.2% in 2011. The trend of credit-GDP ratio is shown in Figure 5.

Figure 5
Credit/GDP
(In Percent)
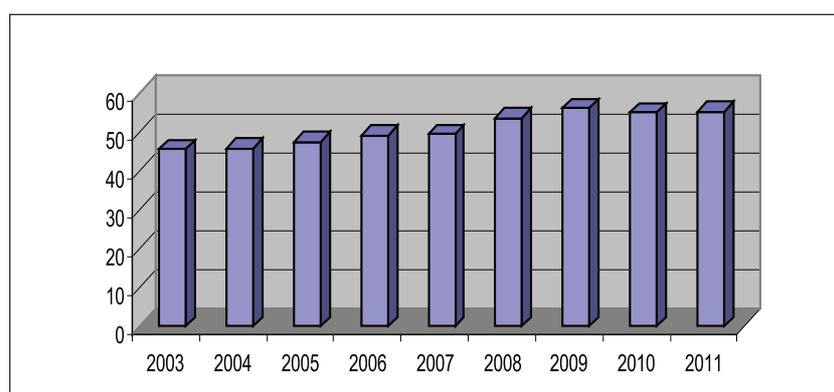
6. Methodology: Framework for Assessing Systemic Risk of Major Financial Institutions

There are various methods for examining the systemic risks of the financial system. For a given confidence interval and time span, Value at Risk (VAR), a market risk measure, indicates the maximum expected portfolio loss under normal market conditions (Benninga and Weiner, 1998). Basle sets a 99% confidence interval and a 10-day horizon, based on at least 12 months historic data. Banks must hold at least three times this VAR amount in capital. Stress tests quantify portfolio movements for unlikely but feasible events (see BIS, 2000 and 2001 for more detail). Early Warning Systems (EWS) generate out-of-sample probabilities of crisis using historic data. Demirguc-Kunt and Detragiache (1997) developed a parametric EWS for banking crises using a multinomial logit model with macroeconomic, financial and structural variables as inputs. Logistic models are appropriate for explaining binary banking crisis observations in panel data.

The CCA is a method that uses Black-Scholes option-pricing techniques to calculate the likelihood of corporate default. It is an extension of the Merton (1974) model based on the insight that a shareholder has an implicit call option on the value of the assets of the firm. The CCA uses both historical balance sheet data (leverage ratio) and timely and forward-looking equity market information (volatility of returns) to calculate a measure called "distance to default". This method measures credit risk by expressing a firm's net worth as a proportion of asset price volatility; the higher this ratio, the lower the likelihood of default. Any asset with a liquid secondary market can be used because, assuming market efficiency, prices should incorporate markets' forward looking expectations of firm default (Chan-Lau, 2006).

This study uses CCA and panel-VAR methodology. In the absence of a robust single measure, a pragmatic approach may be applied to monitor a set of selected indicators, depending on each country's circumstances. According to Brockmeijer, J., Moretti M., et al (2011), the best tools in this regard may be country specific, depending on the level of development, the structure of financial system, the type of monetary and exchange rate policy regime, the openness of economy to capital flows, etc. For each dimension, it proposes to rely on one or two specific analytical tools that are identified as the most robust and useful from an early warning perspective. Importantly, such a system needs to be tailored to individual countries' circumstances—reflecting aspects such as the degree of market development and data availability—and should be revisited and updated over time.

6.1 Theoretical Concept

The study uses a panel data set that includes 12 listed commercial banks and macroeconomic data and follows a two-step procedure to analyse systemic risk of financial stability of Nepal. As a first step, the default risks of banks are calculated using Black and Scholes (1973) option pricing theory. Then, unrestricted panel-VAR methodology is applied for the analysis, which allows the examination of the underlying relationships between efficiency and risk without applying any a-priori restrictions. Finally, the effect of a one standard deviation shock for macroeconomic variables to default risks is analysed. The VAR model and CCA method are briefly explained below.

Vector Autoregression (VAR) Model: Sims (1980) proposed a new method of identifying and interpreting economic shocks in historical data and of analysing how such shocks are gradually transmitted to different macroeco-nomic variables.

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His approach has had an enormous impact on research. It has also been used extensively as a basis for decision-making in economic policy.[6]

VAR analysis can be described in simple terms as a method of extracting structural macroeconomic shocks, such as unexpected exogenous shocks to the central bank's main policy instrument (e.g., the federal funds rate in the U.S.) or unexpected exogenous changes in productivity, from historical data and then analysing their impact on the economy. Thus, this analysis is a tool for: (i) estimation of a forecasting model, by separating unexpected movements in macroeconomic variables from expected movements; (ii) identification, by breaking down these unexpected movements into structural shocks, i.e., shocks that can be viewed as fundamental causes of macroeconomic fluctuations; and (iii) impulse-response analysis, by tracing out the dynamic impact of these shocks on subsequent movements in all of the macroeconomic variables.

Sims proposed that the empirical study of macroeconomic variables could be built around a statistical tool, the vector autoregression (VAR). Technically, a VAR is a straightforward N-equation, N-variable (typically linear) system that describes how each variable in a set of macroeconomic variables depends on its own past values, the past values of the remaining N-1 variables, and on some exogenous shocks.

Contingent Claims Approach: The details of the framework for assessing macro-financial risk to financial institutions are explained in the Appendix 1.

6.2 Data

The study includes financial statements and time series data of the 12 commercial banks of Nepal. The total deposits, total liabilities to total capital ratios, non-performing loans, and total capital are collected and calculated from the regular issues of quarterly financial highlights of commercial banks published in the website of NRB since 2005 to 2010 and from the Quarterly Economic Bulletin. The stock price of individual banks and stock market index data are collected from the Nepal Stock Exchange office, Kathmandu. GDP growth rate is collected from the Economic Survey, 2010/11, published by the Ministry of

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6. See Nobel prize website - Advanced Information Scientific Background: Empirical Macroeconomics.
   <http://www.nobelprize.org/nobel_prizes/economics/laureates/2011/advanced.html>

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Finance, Government of Nepal. As GDP data is published on annual basis in Nepal, it is transformed into quarterly basis using Goldstein and Khan (2010) method[7]. Inflation data are collected from the NRB.

7. Empirical Results: Assessment of Systemic Risk

The study includes eight variables for panel VAR analysis. The variables used are GDP growth rate (Y_G), inflation rate (INF), total deposit (TD), non-performing loans in percentage of total loans (NPL), total liabilities to total capital ratios (TL_TC), stock market index (SMI), total capital (TC), and default probabilities of financial institutions (DEFPROB). The variables NPL and DEFPROB are used as panel data of 12 commercial banks of Nepal and remaining variables are in aggregate.

Most of the sampled banks' probabilities to default are found to be positively correlated with non-performing loans. As depicted in Table 4 below, the correlation coefficients of banks' default probabilities to their non-performing loans are presented for the 12 commercial banks. Out of the 12 correlation coefficients, 10 have positive correlation between the banks' NPL and their probabilities to default. When there are high default probabilities, their NPLs are also high. This indicates that default probabilities could be the indicator to reflect financial stability.

Table 4 Correlation between NPL and Default Probabilities of Banks			
BANK1	0.82	BANK7	0.71
BANK2	0.68	BANK8	-0.61
BANK3	0.42	BANK9	0.47
BANK4	0.07	BANK10	0.44
BANK5	0.67	BANK11	0.80
BANK6	-0.40	BANK12	0.56

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7. For details, see Al-Turki S.M. (1995).

The unrestricted panel-VAR model has been used as a macroeconomic model to analyse the impact of shocks. The study has not tested unit root to check stationarity of the data. It is because "Sims (1980) and Sims, Stock, and Watson (1990) recommend against the differencing even if the variable contain a unit root. They argue that the goal of a VAR analysis is to determine the interrelationships among the variables, not to determine the parameter estimates. The main argument against the differencing is that it "throws away" information of concerning the co-movements in the data such as possibility of cointegrating relationships. Similarly, it is argued that the data need not be detrended."[8]

After estimation of panel-VAR model, three experiments – impact of positive inflation shock, positive GDP shock, bank run shock (10% decrease in deposit) – are conducted to generate the impulse response functions.

Figure 1 in Appendix III depicts the impulse responses of other variables to one standard deviation shocks to GDP growth. The initial impact of shocks has been presented in Table 5. As the GDP growth rate increases, inflation increases, total deposits increases, and total capital increases. However, non-performing loans decreases and ratio of total liabilities to total capital decreases. As a consequence, the default probability of banks also increases. It is can be concluded that boom in the economy would increase the default probabilities of banks.

Table 5
Initial Impact Shocks to the Variables

Shocks to Variables	INF	TD	NPL	TL_TC	SMI	TC	DP	YG
YG ↑ One SD	↑	↑	↓	↓	↑	↑	↑	
INF ↑ One SD		↑	↓	↑	↓	↑	↑	↓
TD ↓ (10 PC)	↓		↑	↓ ↑	↓	↓	↑	↓
PC = Percentage, SD = Standard Deviation and arrows show the direction								

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8.   See Enders, W., (2004), Applied Economic Time Series, 2nd Ed., Wiley Series in Probability and Statistics, pp. 270.

Similarly, the Figure 2 in Appendix III shows the impact of one standard deviation inflation shock to other variables. As shown in the Table 5, increase in inflation increases total deposits, total liabilities to total capital ratio and total capital as well. On the other hand, it decreases GDP growth, stock market activities and non-performing loans as well. As a result, default probabilities increase. The simulation result shows that increase in inflation decreases GDP growth. The negative association between inflation and economic growth is against the Phillips curve relationship. It might be due to the reason that when inflation increases the aggregate supply curve shifts to the left decreasing output.

Figure 3 in Appendix III shows the impact of bank-run shock measured as a fall in deposit by 10% to innovations. The initial impact of the shock is also summarised in Table 5. If there is a fall in deposit by 10%, it decreases GDP growth rate, total capital, inflation and total liabilities to total capital ratio. On the other hand, a fall in deposit increases NPL and default probabilities reflecting financial sector instability in the economy. Therefore, a fall in aggregate deposit increases non-performing loans and is the cause of systemic risks in the Nepali financial sector.

All shocks significantly increased the default probabilities of the banks, i.e., they increase credit risks or the probabilities of default. In the both cases, the increase in economic growth and fall in deposits, default probabilities or risks to financial stability have been increased. It indicates that the agents have strong collective tendency of overexposing themselves to risk in the upswing of a business cycle, i.e., increase in economic growth raises default probabilities. On the other hand, the agents become overly risk-averse, i.e., when there is a downswing (fall in deposits) there is an increase in default probabilities. The study shows that change in economic growth, inflation and bank-run also affect the probability of bank defaults. NRB should closely monitor these variables while formulating its policies.

8. Conclusion

The financial crisis demonstrated that a stable and reliable financial system is a prerequisite for price stability and stable economic growth. The supervisory and regulatory authorities must consider overall financial stability as well as the safety and soundness of individual institutions. Therefore, the NRB has to work so as to better understand the sources of systemic risk, to develop improved monitoring tools, and to evaluate and implement policy instruments to reduce risks to the economy. As the study shows that change in economic growth, inflation and bank-run also affect the probability of bank defaults, the NRB should closely monitor these variables while analysing the systemic risks to the financial institutions. Therefore, macro-prudential policy is crucial in Nepal in addressing these sources of systemic risks. Moreover, macro-prudential, monetary and micro-prudential policies should be implemented in such a way that they can reinforce one other to stabilise financial system and the economy as a whole.

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Framework for Macro-Prudential Policies for Emerging Economies in a Globalised Environment

I.   **Methodology: Framework for Assessing Systemic Risk of Major Financial Institutions**

   1. **Theoretical Concept**

   The Contingent Claims Approach is a structural model based on the Black-Scholes and Merton model. Consider a case of a firm with assets, V, which are financed by debt obligation, F, and Equity, E. The value of the firm's assets is simply the sum of the firm's debt and equity:

   $$V_t = F_t + E_t \tag{1}$$

   The value of the firm's debt obligation is also known as the default barrier, DB. The probability of default ($V_{t+1} < F_{t+1} \ or \ DB$) exists as long as it is greater than zero. This implies that at time t+1, the market value of assets, B_t, is lower than the yield to maturity of the debt, Fe^{-rT}. In this simplified firm structure, the risk is a function of the leverage ratio, $LR = \dfrac{Fe^{-rT}}{B_t}$, the volatility of the rate of return of the firm's assets, σ_v, and the time to maturity of the debt, T. Thus, a creditor who extended a loan to this firm must purchase a put option to eliminate the risk on the loan[1]. The value of the put option, P_o, on the market value of the firm assets, B_t, for the term of the debt must have a strike price, S, equal to the face value of the loan. The creditor can completely eliminate the credit risk and convert the risky loan into a riskless loan. If the riskless interest rate is r, then in equilibrium it should be that:

   $$B_t + P_o = \ Fe^{-rT} \tag{2}$$

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   9.   A put option is a contract between two parties to exchange assets for an agreed amount (strike price) at a specified future date. The buyer of the put, has the right but not the obligation to sell the asset at the strike price. The seller has the obligation to buy the asset once the buyer exercises his right.

In applying the Black-Scholes and Merton model, the value of the put can be written as:

(3)

$$P_o = -N(d_1)B_t + Fe^{-rT} N(-d_12)$$

Where P_o, is the current value of the put, N(.) is the cumulative standard normal distribution, μ is the expected return on the assets, and σ_v is the standard deviation of the rate of return of the firm's assets.

(4)

$$d_1 = \frac{\ln\left[\left(\frac{B_t}{F}\right)\right] + \left(\mu + \frac{1}{2}\sigma^2\right)T}{\sigma_v\sqrt{T}} = \frac{\ln\left[\left(\frac{B_t}{Fe^{-rT}}\right)\right] + \left(\mu + \frac{1}{2}\sigma^2\right)T}{\sigma_v\sqrt{T}}$$

(5)

$$d_2 = d_1 - \sigma_v\sqrt{T}$$

The numerator measures the distance between the expected one-year ahead market value of the firm's assets and the distress barrier. The denominator is used to scale the numerator with respect to units of standard deviations. Thus, the probability of default, ($V_{t+1} < F_{t+1}$ or DB) is as follows:

(6)

Probability of default $= N(-(LN\ V_10/(DB) + (\mu - (\sigma_v^2)/2)T)/(\sigma_v\sqrt{T}))$

Using Equation (5), the expected return on assets, μ, can be computed as follows:

(7)

$$\mu = \max\left[\frac{V_{A,(t)} - V_{A,(t+1)}}{V_{A,(t+1)}}, r\right]$$

where r, is the one year Treasury Bill rate and T, is set to one year so that the probability emerging out of the assessment is the one year ahead probability of default on an *ex ante* basis.

Moreover, the equity of the firm, E_t, is itself a contingent claim on the firm's assets. Since equity holders have a junior claim on the residual value of the assets, the value of the equity can be viewed as a call option. This means that equity holders receive the maximum of market value assets minus the default barrier or nothing in case of default. Given that the firm's equity behaves like a European call option on the firm's assets, the Black-Scholes and Merton model can be used to compute the equity value. The equation for valuing equity as a European call option is:

$$E_1(t) = V_1(t)\, N(d_1 1) - Fe^{-rT} N(d_2) \tag{8}$$

1. Estimating Financial Institution Risk Using the Contingent Claims Approach

In the theoretical concept, it is shown that the Black-Scholes and Merton model can be applied to calculate risks in the financial system by showing the distance of institutions from the default barrier and estimating the probability the default. In cases where the debt and equity are both traded, the market value of assets, *V*, can be reconstructed by adding the market values of both debt and equity as stated in Equation (1). However, practical problem arises in cases where the firm debt is not traded and only equity is traded or vice versa. For this project, the data of the top big banks are limited only to institutions where there are available equity prices. Since most of the participating economies are constrained by market data availability of debt, the default barrier ($\llbracket Fe \rrbracket^\intercal (-rT)$) is determined as a function of the short-term debt and long-term liabilities of the firm.[10]

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10. Crouhy, Michel, et.al., (2001), Risk Management, 1st Edition, pp. 371-374.
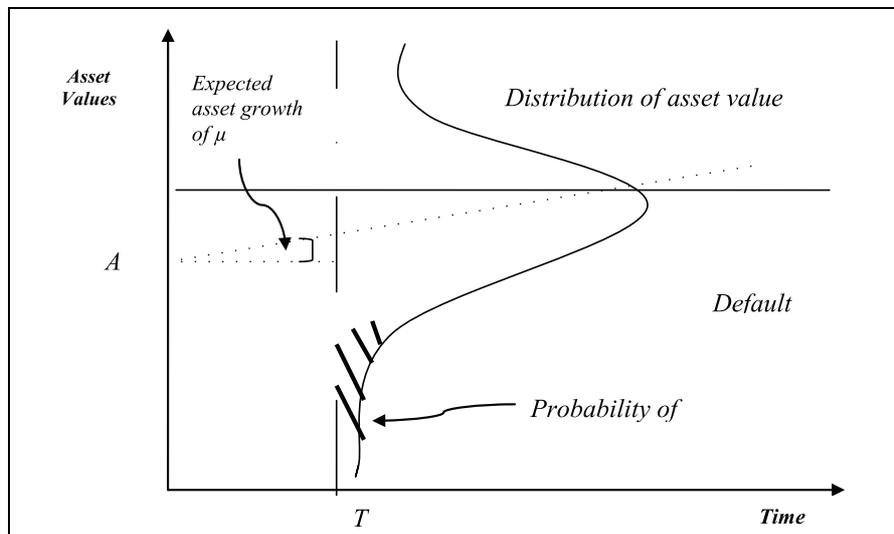
According to the Vasicek and Kealhofer empirical model,[11] firms default when the asset value reaches a level that is somewhere between the value of the total liabilities and the value of the short-term debt. Therefore, the tail of the distribution of asset values below the total debt may not be as accurate as a measure of actual probability of default. The loss of accuracy may result from the non-normality of the asset return distribution or the firm is able to draw on lines of credit (unobservable). Thus, the default barrier is computed as the sum of short-term debt plus half of the long-term debt.

For the market value of equity, , it is equal to the number of outstanding stocks multiplied by the closing stock price as of the balance sheet date. To calculate a single systemic risk indicator, an aggregation technique based on the weighted average market value of assets is used.

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11. The most popular commercial model is the Kealhofer, McQuown and Vasicek (KMV) model.

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Construction of Quarterly GDP Series

Interpolation method is used to derive the quarterly GDP growth rate from annual data, as outlined by Goldstein and Khan (1976). The method has been explained in this section. The task is to approximate the graph of $Y = f(x)$ between the points at which the values of Y are known. That is, we want to approximate the graph of Y between any two annual points. If we represent $f(x)$ by the quadratic function on the form $Y\_G = ar^2 + br + c$, then for any three consecutive annual observations (at years 0, 1 and 2) of Y_G, the approximation of Y_G takes the form[12]:

$$\int_0^1 (ar^2 + br + c)dr = Y\_G_{t-1} \qquad \text{................. (i)}$$

$$\int_1^2 (ar^2 + br + c)dr = Y\_G_t \qquad \text{................. (ii)}$$

$$\int_2^3 (ar^2 + br + c)dr = Y\_G_{t+1} \qquad \text{................. (iii)}$$

Now, integrating, substituting and solving equations for a, b and c gives:

$$a = 0.5Y\_G_{t-1} - Y\_G_t + 0.5\ Y\_G_{t-1} \qquad \text{................. (iv)}$$

$$b = -2\ Y\_G_{t-1} + 3\ Y\_G_t - Y\_G_{t+1} \qquad \text{................. (v)}$$

$$c = 1.8333\ Y\_G_{t-1} - 1.1666\ Y\_G_t + 0.333\ Y\_G_{t+1} \qquad \text{................. (vi)}$$

Then the four quarterly data within a given year can be interpolated respectively, by using:

$$Q_1 = \int_1^{1.25} (ar^2 + br + c)dr = 0.05468\ Y\_G_{t-1} + 0.23438\ Y\_G_t - 0.039067\ Y\_G_{t+1} \qquad \text{........ (vii)}$$

$$Q_2 = \int_{1.25}^{1.50} (ar^2 + br + c)dr = 0.00781\ Y\_G_{t-1} + 0.26563\ Y\_G_t - 0.02344\ Y\_G_{t+1} \qquad \text{........ (viii)}$$

$$Q_3 = \int_{1.50}^{1.75} (ar^2 + br + c)dr = -0.02344\ Y\_G_{t-1} + 0.26562\ Y\_G_t + 0.00781\ Y\_G_{t+1} \qquad \text{........ (ix)}$$

$$Q_4 = \int_{1.75}^{2} (ar^2 + br + c)dr = -0.0391\ Y\_G_{t-1} + 0.23437\ Y\_G_t + 0.05469\ Y\_G_{t+1} \qquad \text{.......... (x)}$$

The above equations can be used to derive quarterly data series.

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12. For details, see Al-Turki S.M. (1995).

Output of the Study

Vector Autoregression Estimates								
	Y_G	INF	TD	NPL	TL_TC	SMI	TC	DEFPROB
Y_G(-1)	0.412398	0.881748	4742.731	-0.006020	-0.898219	40.56163	1691.126	2.483233
	(0.04983)	(0.13187)	(1117.33)	(0.00269)	(0.12274)	(9.91397)	(162.067)	(0.71079)
	[8.27639]	[6.68628]	[4.24472]	[-2.23907]	[-7.31827]	[4.09136]	[10.4347]	[3.49364]
INF(-1)	-0.257965	0.916023	3184.821	-0.000957	0.133149	-22.07632	38.22886	1.023118
	(0.01730)	(0.04578)	(387.869)	(0.00093)	(0.04261)	(3.44154)	(56.2602)	(0.24674)
	[-14.9135]	[20.0097]	[8.21106]	[-1.02521]	[3.12506]	[-6.41466]	[0.67950]	[4.14649]
TD(-1)	8.59E-06	2.78E-06	0.872747	-1.26E-07	-9.06E-05	0.004551	0.136179	-2.73E-05
	(2.4E-06)	(6.4E-06)	(0.05417)	(1.3E-07)	(6.0E-06)	(0.00048)	(0.00786)	(3.4E-05)
	[3.55497]	[0.43533]	[16.1104]	[-0.96791]	[-15.2295]	[9.46741]	[17.3305]	[-0.79313]
NPL(-1)	0.102100	-0.221118	2456.482	0.935546	-0.065763	14.57298	461.2965	10.89872
	(0.40488)	(1.07154)	(9078.77)	(0.02185)	(0.99729)	(80.5554)	(1316.87)	(5.77545)
	[0.25218]	[-0.20636]	[0.27057]	[42.8219]	[-0.06594]	[0.18091]	[0.35030]	[1.88708]
TL_TC(-1)	-0.105171	0.230179	-901.7036	-0.002455	-0.205283	-27.92727	75.49338	0.469827
	(0.01865)	(0.04936)	(418.182)	(0.00101)	(0.04594)	(3.71051)	(60.6571)	(0.26603)
	[-5.63944]	[4.66360]	[-2.15625]	[-2.43995]	[-4.46883]	[-7.52654]	[1.24459]	[1.76609]
SMI(-1)	0.000625	0.001841	-7.658457	1.17E-05	-0.002494	0.209955	-9.633741	-0.004451
	(0.00035)	(0.00092)	(7.81770)	(1.9E-05)	(0.00086)	(0.06937)	(1.13395)	(0.00497)
	[1.79256]	[1.99571]	[-0.97963]	[0.62062]	[-2.90462]	[3.02676]	[-8.49571]	[-0.89507]
TC(-1)	-5.12E-05	2.30E-05	0.394444	2.57E-07	0.000309	-0.034868	0.207030	0.000144
	(1.8E-05)	(4.7E-05)	(0.39992)	(9.6E-07)	(4.4E-05)	(0.00355)	(0.05801)	(0.00025)
	[-2.86867]	[0.48652]	[0.98632]	[0.26752]	[7.03220]	[-9.82643]	[3.56903]	[0.56771]
DEFPROB(-1)	0.001073	0.002806	0.310877	1.13E-05	-0.003107	-0.022637	1.604715	0.858127
	(0.00259)	(0.00684)	(57.9654)	(0.00014)	(0.00637)	(0.51432)	(8.40785)	(0.03687)
	[0.41502]	[0.41012]	[0.00536]	[0.08087]	[-0.48790]	[-0.04401]	[0.19086]	[23.2715]
C	3.837286	-8.949812	31175.59	0.104913	48.61181	116.8749	-31373.20	-15.85716
	(0.49808)	(1.31820)	(11168.7)	(0.02688)	(1.22687)	(99.0992)	(1620.01)	(7.10496)
	[7.70417]	[-6.78940]	[2.79134]	[3.90352]	[39.6228]	[1.17937]	[-19.3660]	[-2.23184]
R-squared	0.817640	0.818639	0.992315	0.919827	0.947466	0.791877	0.993644	0.799793
Adj. R-squared	0.810593	0.811630	0.992020	0.916728	0.945436	0.783834	0.993399	0.792055
Sum sq. resids	43.65725	305.7913	2.20E+10	0.127119	264.8827	1728225.	4.62E+08	8883.481
S.E. equation	0.459244	1.215423	10297.87	0.024781	1.131206	91.37240	1493.700	6.550982
F-statistic	116.0149	116.7966	3341.159	296.8637	466.6661	98.45050	4045.389	103.3661
Log likelihood	-133.8086	-344.0342	-2297.668	496.8039	-328.5237	-1277.122	-1880.641	-707.8911
Akaike AIC	1.322301	3.268835	21.35804	-4.516703	3.125219	11.90854	17.49667	6.637881
Schwarz SC	1.462938	3.409472	21.49867	-4.376066	3.265856	12.04917	17.63731	6.778517
Mean dependent	4.050000	9.248273	431003.7	0.051039	13.85775	635.1833	32807.73	11.12304
S.D. dependent	1.055224	2.800412	115264.9	0.085876	4.842712	196.5264	18384.58	14.36589
Determinant resid covariance (dof adj.)	5.51E+14							
Determinant resid covariance	3.92E+14							
Log likelihood	-6080.941							
Akaike information criterion	56.97168							
Schwarz criterion	58.09677							

Figure 3.1
Graphical Presentation of Data
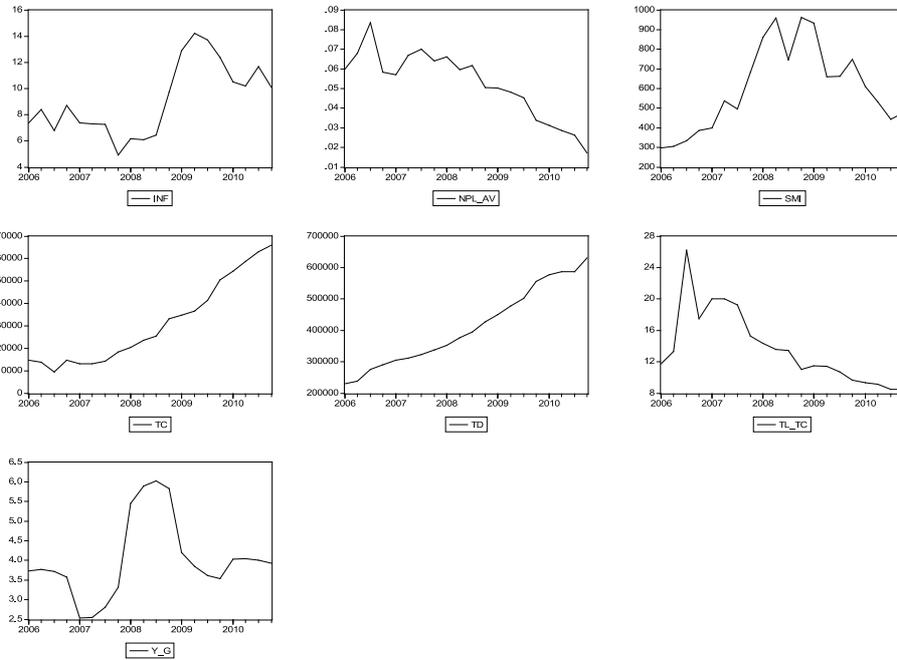
B: Impulse Response Functions of VAR Analysis

Fig. 3.2
Response to One Standard Deviation GDP Shock

Response to Nonfactorized One S.D. Innovations ± 2 S.E.

Fig. 3.3
Response to One Standard Deviation Inflation Shock

Response to Nonfactorized One S.D. Innovations ± 2 S.E.
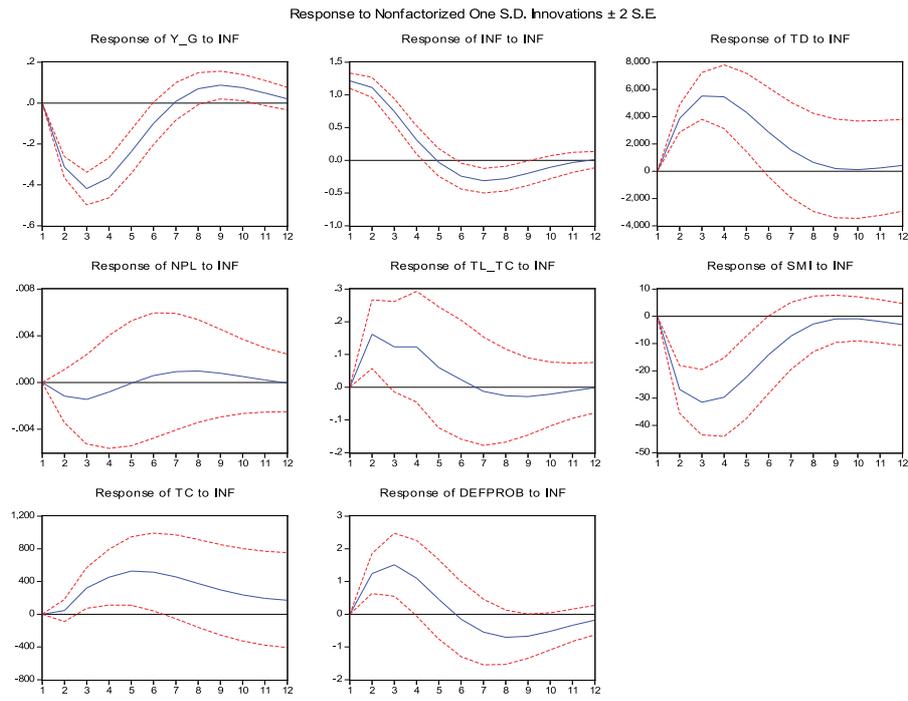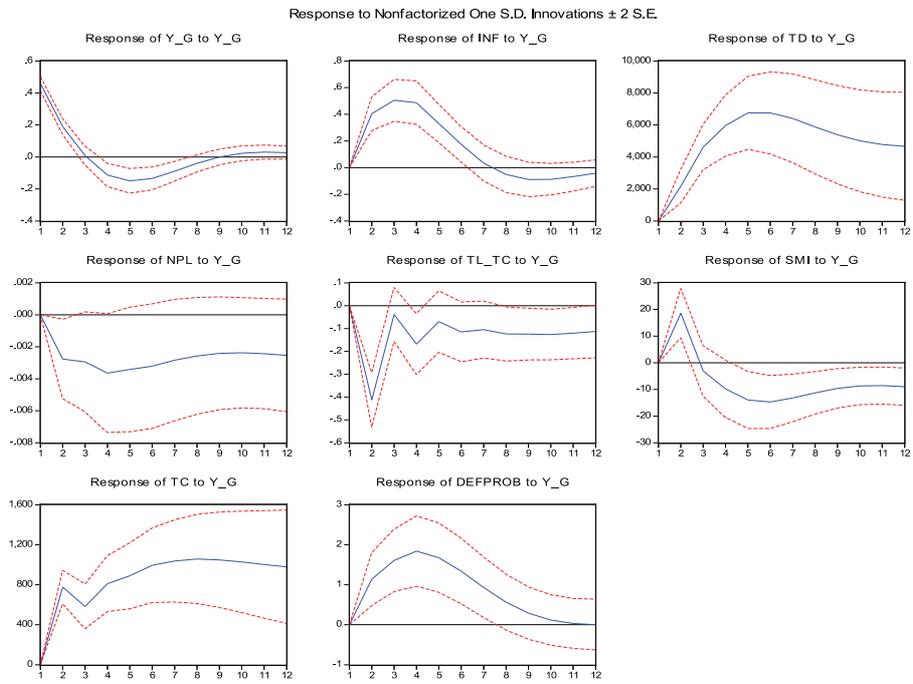
Fig. 3.4
Response to 10% Fall in Deposit

Effect of 10 % Fall in Total Deposit
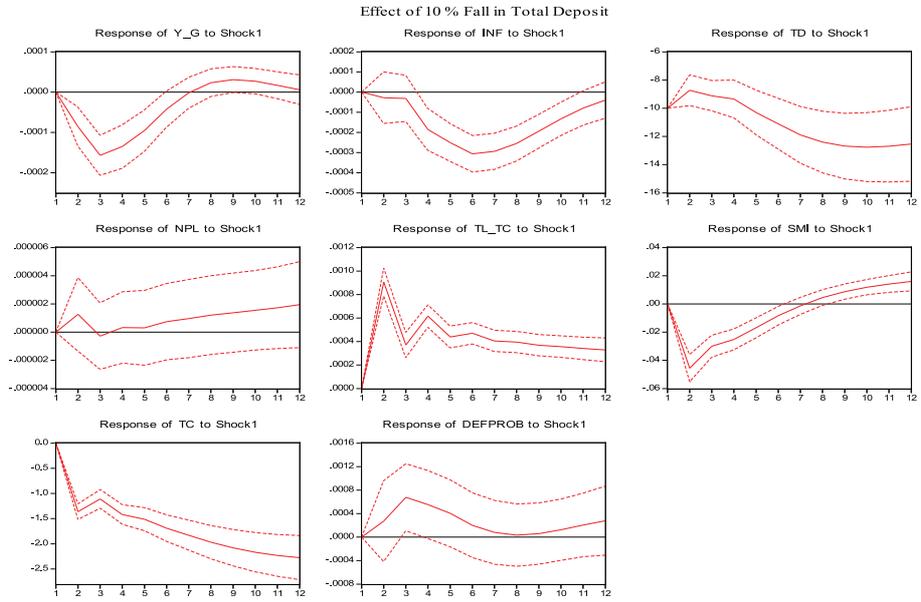
Default Probabilities of Banks

FISCAL YEAR	QUARTER	BANK1	BANK2	BANK3	BANK4	BANK5	BANK6	BANK7	BANK8	BANK9	BANK10	BANK11	BANK12
2005/06	Q1	..	..	..	..	..	..	..	..	..	..	..	..
2005/06	Q2	25.842	5.342	10.583	26.459	40.247	19.353	1.902	21.494	1.897	20.435	19.032	0.692
2005/06	Q3	27.557	5.571	10.489	26.659	42.479	18.499	1.964	21.386	2.007	20.204	19.634	0.699
2005/06	Q4	26.823	5.670	10.761	28.357	39.998	18.011	1.943	21.342	1.957	20.902	19.623	0.712
2006/07	Q1	12.357	0.780	8.170	22.952	47.889	47.206	0.059	28.176	0.058	18.284	15.713	2.666
2006/07	Q2	13.271	0.840	8.471	23.711	46.703	48.365	0.067	29.149	0.058	20.057	16.607	2.813
2006/07	Q3	12.831	0.776	8.125	22.748	49.246	47.908	0.061	29.792	0.058	18.542	15.959	2.714
2006/07	Q4	13.185	0.826	8.512	22.666	49.729	49.582	0.065	30.554	0.061	19.920	17.668	2.903
2007/08	Q1	2.743	3.410	0.535	7.342	34.016	4.335	0.000	4.666	0.011	3.209	0.217	0.000
2007/08	Q2	2.965	3.410	0.545	8.517	43.415	4.978	0.000	5.989	0.011	3.567	0.262	0.000
2007/08	Q3	2.611	3.250	0.497	7.379	36.557	4.410	0.000	4.586	0.010	3.102	0.210	0.000
2007/08	Q4	2.904	3.347	0.564	7.970	40.563	4.718	0.000	5.398	0.011	3.474	0.242	0.000
2008/09	Q1	8.147	0.038	10.363	46.275	32.747	14.002	0.000	16.891	0.734	24.673	0.005	0.007
2008/09	Q2	7.438	0.035	9.623	44.835	38.399	13.486	0.000	15.289	0.656	21.730	0.004	0.006
2008/09	Q3	7.411	0.035	9.309	43.557	35.670	13.923	0.000	15.176	0.674	21.721	0.004	0.006
2008/09	Q4	7.993	0.039	9.342	41.190	37.169	13.328	0.000	16.609	0.662	23.154	0.004	0.006
2009/10	Q1	0.776	0.000	0.000	0.331	23.244	0.150	0.000	40.457	0.000	6.589	2.365	0.000
2009/10	Q2	0.761	0.000	0.000	0.327	23.097	0.150	0.000	40.297	0.000	6.287	2.357	0.000
2009/10	Q1	0.744	0.000	0.000	0.325	25.014	0.149	0.000	42.607	0.000	6.233	2.286	0.000
2009/10	Q2	0.773	0.000	0.000	0.340	26.074	0.153	0.000	41.477	0.000	6.470	2.335	0.000

Note: *The default probabilities of sampled banks are calculated using Contingent Claims Approach (CCA) The name of banks is not disclosed because of such information might be the sensitive.*

Time Series Data

Time Series Data							
YEAR	QUARTER	SMI	TC	TD	TL_TC	Y_G	INF
2005	Q1	297.3	14755.35	230651.2	11.77626	3.73125	7.3786
2005	Q2	305.5	13799.83	238343.2	13.32773	3.76875	8.37838
2006	Q3	334.8	9371.152	275395.8	26.23966	3.71875	6.81442
2006	Q4	386.8	14608.82	290741.4	17.47961	3.58125	8.72483
2006	Q1	398.4	13088.49	304330	20.00655	2.528125	7.38058
2006	Q2	537.1	13088.49	311574.8	20.00655	2.546875	7.30865
2007	Q3	494.6	14327.62	322421.5	19.24395	2.809375	7.27167
2007	Q4	683.9	18281.2	338045.4	15.24793	3.315625	4.90086
2007	Q1	861.4	20433.6	351517.4	14.35473	5.45625	6.16226
2007	Q2	958.9	23578.46	376054.3	13.56065	5.89375	6.09582
2008	Q3	746.7	25343.1	394625.8	13.46027	6.01875	6.45336
2008	Q4	963.4	33065.41	426448	11.03378	5.83125	9.71826
2008	Q1	934	34752.03	450137.4	11.45847	4.20625	12.8971
2008	Q2	659.8	36664.18	478457.3	11.43148	3.84375	14.2376
2009	Q3	661.3	41446.72	502558.6	10.73201	3.61875	13.7035
2009	Q4	749.1	50459.74	555145.3	9.67326	3.53125	12.3678
2009	Q1	609.6	54374.38	576766.8	9.36575	4.034375	10.4959
2009	Q2	531	58670.47	586561.2	9.143703	4.040625	10.177
2010	Q3	444.8	63049.02	586003.8	8.511582	4.003125	11.6637
2010	Q4	477.7	65936.27	631282.5	8.489602	3.921875	10.0956

Chapter 7

A MACRO-PRUDENTIAL ASSESSMENT
FOR THE PHILIPPINES

By
Enrico R. Amat[1]

1. Introduction

The banking system is a vibrant sector of the Philippine economy at a critical juncture in a tumultuous time. After emerging relatively unscathed during the Asian crisis in the late 1990s, the Philippine banks have remained sound benefiting largely from the continuing reforms pursued by the monetary authorities. But more than a decade after Asia's worst financial crisis, the Philippine banks are once more on a rough ride. Caught in the cross currents of the ongoing fiscal crisis in Europe, the aftermath of the natural calamities that struck Japan, the headwinds of the great recession in the US, and the predicted slow-down of emerging markets particularly India and China, the Philippine banks again are facing challenging times. The developments happening in the global financial system are once again testing the resilience of Philippine banks to withstand threats to their stability. They serve as litmus test to the effectiveness of the years of reforms set in place by the country's monetary authorities.

Through the course of its history, the Philippine banking system has gone through many challenges which inspired among regulators a kind of mindset to take a more pro-active stance in safeguarding the stability of the local financial system. Indeed, long before the term macro-prudential was coined, the country's monetary authorities were already laying down macro-prudential regulations in step with the developments in the local financial environment. As early as the late 60's, for example, the central bank already had prudential rules such as limits for banks' holding of government deposits and a "liquidity floor" to support

such deposits.[2] By the middle of that decade, the regulators had also been applying limits on loans extended to the corporations in which bank directors, officers, and stockholders held equity or the so-called DOSRI loans.

Addressing weaknesses in banks' capital during the early 70's, the central bank increased minimum capital requirements and encouraged the merger and infusion of foreign equity in domestic financial institutions. The regulators also extended their supervisory role to include those entities in the money market business. At the turn of the decade, the tact of the central bank changed towards supporting the country's economic development in the 80's. Universal banks were introduced. These were banks given licences to underwrite securities and take equity positions in manufacturing, agricultural and other enterprises. Other reforms were also introduced during this period which sought to liberalise interest rates and promote competition and saving mobilisation in support of the then expanding economy.

The Philippine banking system entered a new era in the 1990s that is marked by two important changes in regulations. First is the enactment of the New Central Bank Act through which the central bank's dominance in monetary policy was amalgamated. The second is the liberalisation of bank licensing which opened the doors to more players and paved the entry of several foreign banks into the industry creating a new element of competition.

During this decade, the monetary authorities pursued further reforms and prudential regulations. These included the phased increase in banks' minimum capitalisation requirements to encourage more prudent financial intermediation and to provide stability and cushion in the event of difficulties and shocks. Single borrower limits as well as restrictions on connected lending, and stricter audit and reporting requirements were imposed. By the end of the 90's, a limit of 20% on bank lending to the real estate sector was introduced followed by a reduction to 60% in the loan value of the real estate used as collateral for bank loans. Likewise, a liquid asset cover of 30% against foreign currency deposits was required[3]. These measures implemented by the central bank successfully insulated the local economy when the Asian financial crisis unfolded and helped the country emerged out of the crisis on a more solid footing.

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2. Hutchcroft, Paul D., (1998), *Booty Capitalism: The Politics of Banking in the Philippines*, pp, 106.

3. Tuano-Amador, Ma. Cyd, (2009), "Asian Financial Crisis of 1997-1998 and the Philippine Economy", *Central Banking and Challenging Times -The Philippine Experience*, Bangko Sentral ng Pilipinas, pp. 279-280.

In the dawn of the new millennium, the Philippine banking system saw the General Banking Law took effect in May 2000. This new law enhanced the supervisory capacity of the central bank and enabled the banking industry to better endure shocks exacted by the increasingly globalised and competitive financial markets.[4] For its part, the Bangko Sentral ng Pilipinas (BSP), implemented the risk-based capital adequacy framework espoused under Basel I and II. These upgrades in regulatory framework sent strong signals to banks to upgrade their risk management systems, build up their capital bases and reduce their exposures particularly to non-performing accounts and complex products.

These new set of reforms, along with those instituted in the past, provided the cornerstone of stability in the banking system and the greater financial system. They clearly prepared the banking system well, so that, when the global financial crisis in the US unraveled in the later part of 2008, the Philippine banks and the financial system at large remained steadfast even when the crisis persisted and spread over Europe and the rest of the developed world.

It can be said that the Philippine banking system has been fortunate to withstand two major financial crises over the past two decades and still came out of them in better shape. And so, the continuing challenge for the monetary authorities and the banking system is to safeguard the fruits of reforms in the past and the gains of prudential regulations currently in place.

This in fact is well recognised within the central bank where one of its senior officials quite succinctly put, that in view of the costs of crises, the foremost concern for policymakers is how to identify the causes of crises and prevent them. Further, acknowledging that since it would be impossible to detect all types of crisis early enough, prevention is the key. This involves a pragmatic approach of carefully monitoring early warning systems and other indicators that would detect emerging risks and vulnerabilities so that policymakers can implement appropriate and timely policy responses.[5]

Within this context, it is therefore the aim of this paper to introduce the Contingent Claims Approach (CCA) as a methodology for assessing bank vulnerabilities and offer a potential tool, among the many available, for detecting emerging risks in the financial system at the individual bank level and potentially at the sector level. In doing so, we could provide an assessment of the underlying

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4.   Ibid., pp.282-283.

5.   Ibid., 290-291.

risk characteristics of the financial institutions and evidences of the effectiveness of the prudential policies in place for keeping the soundness of banks.

This paper begins by providing a definition in Section 2 of the term 'macro-prudential' while tracing back the initial understanding of and developments in the area of macro-prudential regulations. Then, a framework for assessing systemic risk through the CCA is the main discussion of Section 3. This section initially paints the current state of the Philippine banking system to serve as a take off point for introducing the CCA approach. The risk indicators which are components of the CCA are subsequently applied as a forward-looking approach to assess the risks of selected Philippine banks. Sections 4 and 5 extend the analysis by utilising the vector autoregressive model to identify the vulnerabilities of the sampled financial institutions to changes on the conditions in specific macroeconomic indicators. Section 6 highlights the elements of a macro-prudential framework and the current efforts at the BSP towards adopting them. Finally, Section 7 concludes with some policy recommendations.

2. Macro-prudential Policy Objectives and Instruments

2.1 Definition

In the aftermath of every financial crisis, regulators find new ways to enhance their abilities to monitor the emergence of risks in the financial system and to assess the effectiveness of their policy tools in safeguarding the financial institutions against these risks. The recent crisis that struck the global financial system in 2008-2009 similarly paved the way for innovative approaches by regulators to respond to the challenges the crisis brought forth. Policymakers, particularly central bankers, dug deep into the existing academic theories as well as in their arsenal of policies to better understand the anatomy of the crisis and to mount calibrated responses to bring back stability in the financial landscape.

In the course of unending discussions and debates in forums between policymakers, academics and various stakeholders, the term 'macro-prudential' emerged particularly among policy circles. The use of 'macro-prudential', though, has its beginnings as far back as the late 1970's to generally denote a systemic or system-wide orientation of regulatory and supervisory frameworks and the link to the macroeconomy.[6] However, the BIS cited that public literature on macro-prudential policy surfaced only in the 1980s referring to it as a "policy aimed at supporting the safety and soundness of the financial system as a whole,

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6.   Borio, Claudio, (2009), *Financial Stability Review,* No.13, Banque de France, September.

as well as the payments mechanism". However, the BIS also cited that only over the past two years has the term 'macro-prudential' become more widely used in many speeches but in terms of published references, the use of 'macro-prudential' has remained small.

Today, the term 'macro-prudential' refers to an orientation or perspective of regulatory and supervisory arrangements calibrated from a system-wide or systemic perspective, rather than from that of the safety and soundness of individual institutions on a stand-alone basis. It likewise refers to following a top-down approach, working out the desirable safety standard for the system as a whole and, from there, deriving that of the individual institutions within it. It also means taking explicitly into account the fact that drivers of risk depend on the collective behaviour of financial institutions and are not something outside their influence.[7]

At the BSP, 'macro-prudential' more formally circulated in the bank's lexicon when discussed within a chapter of a published reference. The term is described in the context of supervision as one which "focuses on the financial system as a whole and involves the monitoring, assessment, and mitigation of systemic risk, defined as the likelihood of failure of a significant part of the financial system".[8]

2.2 Policy Objectives

It may be useful to refer to a work of the BIS which broadly accounted for the body of literature that tackles the specific goals of macro-prudential policy.[9] This literature presented the general view on macro-prudential policy that it *is all about limiting the risks and costs of systemic crises, although there are differences in language and emphasis.*

Brunnermeier, et al. (2009) are cited to have argued that one key purpose of macro-regulation is to act as a countervailing force to the natural decline in measured risks in a boom and the subsequent rise in measured risks in the subsequent bust. The Bank of England (2009) has been noted to describe in general terms the aim of macro-prudential policy which should be the stable

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7. Borio, Claudio, (2010), Bank for International Settlements.

8. Espenilla Jr., Nestor A., (2009), " Financial Regulation and the Central Bank", *Central Banking in Challenging Times: The Philippine Experience*, pp. 462-524.

9. Galati, Gabriele and Moessner, Richhild, (2011), *BIS Working Paper*, No. 337.

provision of financial intermediation services – payment services, credit intermediation and insurance against risk – to the economy, trying to avoid the type of boom-bust cycles in the supply of credit and liquidity that were manifested during the recent financial crisis.

An alternative view defined the goal of macro-prudential policy as limiting the risk of episodes of a system-wide distress that have significant macroeconomic costs (Borio and Drehmann, 2009a). This objective is elucidated further within the BIS by describing the objective of macro-prudential policy as "to reduce systemic risk by explicitly addressing the inter-linkages between, and common exposures of, all financial institutions, and the procyclicality of the financial system" (Caruana, 2010b).

Visco (2010) presented the broad consensus that emerged on macro-prudential policies directed to preserving financial stability. He described the idea that these macro-prudential policies should limit systemic risk by addressing both the cross-sectional dimension of the financial system, with the aim of strengthening its resilience to adverse real or financial shocks, and its temporal dimension, to contain the accumulation of risk over the business or financial cycle. [10]

Through the lens of BSP supervisors though, macro-prudential policy is an approach deemed to cover both the analysis and monitoring of risks including the development of appropriate instruments to contain the risks (Espenilla, 2009).

2.3 Instruments and Intervention

The macro-prudential tools that have been growing recognition can be described as those adapted from existing micro-prudential instruments. These tools are broadly categorised into those that focus on addressing the time-series dimension of stability, that is, the procyclicality in the financial system; and those that are geared towards the cross-sectional dimension, that is, how risk is distributed at a point in time, such as the contribution to systemic risk of individual institutions (Borio, 2009).

Instruments that may fall in the first dimension include regulatory capital requirements that are suggested to be imposed in good times at a level that far

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10. Ignazio Visco, (2011), "Key Issues for the Success of Macro-prudential Policies", *BIS Paper,* No. 60. This view was presented in the conference in Korea on macro-prudential policies.

exceeds the minimum capital ratios markets might require during bad times.[11] Loan-to-value (LTV) ratios are also often used to limit banks' exposures to a specific sector of the economy such as real estate and in some cases to a segment within the sector, i.e., development of golf courses. Loan-loss provisions are instruments that can similarly be designed in counter-cyclical variations to limit the procyclicality that characterises the granting of loans.

Regulators over the years have paid greater attention to the share of short-term debt in banks' liabilities which have caused increased vulnerability in banks. Tools that were developed such as the net stable funding ratio or liquidity coverage have focused on the maturity structure of banks' balance sheets.[12] These instruments classified under tools that address the cross-sectional dimension of stability may be augmented, in the words of Brunnermeier, et al (2009), by imposing capital requirement surcharges that are proportional to the size of maturity mismatch.

Interestingly, these instruments have been observed as quite common in the policy tool box of many emerging markets even before the nomenclature 'macro-prudential' has been widely used. As pointed out by Espenilla (2009), macro-prudential supervision is not new to the BSP. He emphasised that it is a natural consequence of the BSP being both the monetary authority and the banking supervisory authority and added that the importance of the macro-prudential tools was underscored in the post-mortem on the 1997 Asian financial crisis.

Owing perhaps to BSP's wealth of experience in managing crisis episodes such as the debt crisis of 80s and the Asian crisis of the 90s, the PSB developed over time forward-looking models for assessing systemic risk that provide the basis for the deployment of its own macro-prudential policies. Among these are Early Warning System (EWS) models designed to detect vulnerabilities in the macroeconomy emanating from a potential currency crisis event and those risks

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11. Hanson, Samuel G.; Kashyap, Anil K. and Stein, Jeremy G., (2011), *Journal of Economic Perspectives*, Vol.25, No.1, pp. 3-28.

12. Once more, Hanson, et al (2011) cited the works of Diamond and Dybvig (1983) and of Stein (2010a) to present a case for regulating the use of short-term debt by financial firms. The first argument is the ability of short-term lenders to run, leading to more fragility than in the case with an equivalent amount of long-term debt. In the second argument, the choice of debt maturity creates an externality in the presence of market-wide fire sales. During a crisis scenario, a financial institution facing an inability to roll over short-term debt will be forced to liquidate assets thererby imposing a fire sale cost on others which hold the same assets. This results in a short-term financing that is socially excessive, hence, the role for regulation.

arising from the deterioration in individual bank's solvency. It also developed a stress testing model which looks into the absorption capacity of banks' capital and a credit risk stress test model which measures the amount of risk in the financial system ex-ante and its implication for the economy. [13]

3. Framework for Assessing Systemic Risk of Major Financial Institutions

The BSP has been very pro-active in the performance of its regulatory and supervisory mandates. In spite of this, the near cataclysmic aftermath of the global financial crisis in 2008 provided the central bank with even more impetus to establish better ways of identifying systemic risks and to set in place a framework for managing them. The central bank acknowledges the necessity for a systematic and wide-ranging exercise of macro-prudential supervision given the potential for great damage of systemic breakdowns. The BSP spelled out the considerations to analyse and monitor risks which include: (1) capturing all the key components of the financial system, namely intermediaries, markets, and infrastructure, and understanding how they interact; (2) covering the interaction between the financial system and the economy; and (3) assessing the impact of financial innovation (Espenilla, 2009).

Within this context, this section introduces the CCA as a possible tool for monitoring and analysing macro-financial risks. One advantage of using the CCA approach is that it uses the market prices of a firm's debt and equity to compute the default probability of the firm. Because market prices represent collective views and forecasts of many investors, the CCA methodology is a forward-looking tool and helps increase the predictive power of the estimates of default risk.[14] Another advantage of the CCA is that it can be used to estimate indicators of risk at the aggregated industry level which can be extended to a multi-sector coverage in which linkages between the corporate, financial and public sectors can be looked into. While a multi-sector level study will not be covered in this paper, extending the CCA at the aggregated industry level provides a useful starting point towards developing a systemic-wide risk analytical framework.

To understand how the CCA can be deployed for risk analysis of banking institutions, we begin by providing an overview of the current state of the Philippine banking system. With this as background, we then apply the CCA

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13. Donovan, Maria Merzenaida, (2011), The SEACEN Centre.

14. See Gapen, Michael T., et al., (2004), *IMF Working Paper*.

methodology to depict the underlying risks in banks which may not be fully captured by the traditional risk indicators.

3.1 The Philippine Banking System

The Philippine banks in 2011 have shown remarkable tenacity in withstanding the tailwinds of the global financial crisis that featured the worsening of credit risks in Europe. As a case in point, the banking system has posted solid gains in key balance sheet accounts featuring an expansion in deposit base, improvement in asset quality, increase in capitalisation, enhancement in profits and growth in liquidity.

3.2 Assets and Asset Quality

Total resources of banks expanded by 11.5% to P7.01 trillion in the first half of 2011 due to the continued growth in the assets of universal and commercial banks (12.3%), thrift banks (5.3%) as well as those of rural and cooperative banks (5.1%). Universal banks captured the largest share at 89.3% of banks' total assets with the remaining distributed between thrift banks (8.1%) and rural and cooperative banks (2.6%), respectively (Figure 1). The higher resources of banks allowed them to serve the required credit needs of the productive sectors of the economy, invest in financial assets other than loans and maintain a comfortable liquidity position in the course of 2011.

Figure 1
Philippine Banking System Asset Growth For End-Periods Indicated
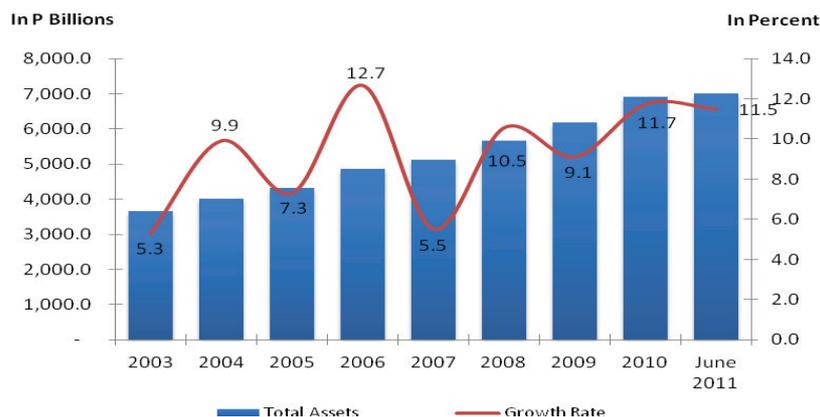
Source: A Status Report on the Philippine Financial System 1st Semester 2011.

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On the other hand, the sustained expansion of the economy as well as the positive business sentiment in the country has benefited the loan portfolios of banks which showed increases by as much as 19% towards end-June 2011. This was a significant improvement over the 5.4% recorded in the same period last year. Core lending (total loan portfolio, net of inter-bank loans and reverse repurchase transactions with BSP) likewise increased by double-digits at 17% which is twice as large as the 8.5% expansion of the previous year.

By exposure to economic activities, the loan portfolio structure of banks is distributed across the financial intermediation sector cornering the biggest segment of domestic credit at 20.8% equivalent to P738.7 billion (Figure 2). This was followed by lending to the real estate sector at 15.3% or P541.2 billion and manufacturing at 12.2% or P434.3 billion.

Figure 2
Outstanding Loans to Economic Activity

	End-June 2011							
	Total	UKBs	TBs	RCBs[1]	Total	UKBs	TBs	RCBs[1]
	Levels (In Billion Pesos)				Share (In%)			
TOTAL	3,548.3	3,059.5	371.2	117.7	100.0	100.0	100.0	100.0
Agriculture	378.1	319.7	19.3	39.1	10.7	10.4	5.2	33.2
Fishing	5.4	3.8	0.7	0.9	0.2	0.1	0.2	0.8
Mining and Quarrying	21.1	20.8	0.1	0.2	0.6	0.7	0.0	0.2
Manufacturing	434.3	419.5	12.9	1.9	12.2	13.7	3.5	1.6
Electricity, Gas & Water	258.9	255.9	2.6	0.4	7.3	8.4	0.7	0.3
Construction	39.7	32.2	4.4	3.2	1.1	1.1	1.2	2.7
Wholesale, Retail, Trade & Repair	338.0	291.0	25.0	22.0	9.5	9.5	6.7	18.7
Transportation, Storage & Communication	182.0	172.4	6.6	3.0	5.1	5.6	1.8	2.6
Financial Intermediation [2]	738.7	686.3	50.7	1.7	20.8	22.4	13.7	1.5
Real Estate, Renting & Business Activities	541.2	400.5	127.5	13.3	15.3	13.1	34.3	11.3
Public Administration & Defense	68.7	68.4	0.2	0.1	1.9	2.2	0.1	0.1
Education	16.1	9.3	2.0	4.7	0.5	0.3	0.5	4.0
Health & Social Work	14.4	10.6	3.0	0.8	0.4	0.3	0.8	0.7
Other Community, Social & Personal Act.	90.4	64.3	13.4	12.8	2.5	2.1	3.6	10.9
Private Households w/ Employed Persons	40.0	29.1	3.5	7.4	1.1	1.0	0.9	6.3
Extra Territorial Organizations and Bodies	-	-	-	-	-	-	-	-
Hotels and Restaurants	40.4	35.9	3.5	1.0	1.1	1.2	0.9	0.9
Others [3]	340.8	239.9	95.7	5.1	9.6	7.8	25.8	4.4

Details may not add up to totals due to rounding-off
1/ Data as of end-March 2011
2/ Inclusive of Interbank Loans
3/ Loans to Individuals for Consumption Purposes - composed of Credit Card Receivables, Auto Loans and Other Loans to Individuals for Consumption Purposes

Source: A Status Report on the Philippine Financial System 1st Semester 2011.

Increases in the loan portfolios of Philippine banks did not at all lead to any worsening in the quality of loans. Banks continuing efforts towards asset clean-up together with a general improvement in their credit risk management have consequently brought their key ratios of asset quality down to pre-Asian crisis levels. For instance, the ratio of non-performing loans (NPLs) in the first half of 2011 markedly declined to 3.1% of total loan portfolios or P108.8 billion compared to the 3.9% of loans or P122.1 billion recorded in the same period last year.

It helped that the financial institutions are able to decrease their holdings of foreclosed properties through dispositions via joint venture agreements, public auctions and negotiated sales. This resulted in the decline of the ratio of banks' real and other properties acquired (ROPA) over gross assets to 2.1% in the first semester of 2011 from their year ago ratio of 2.9%. Such undertaking by banks also led to the decline in their stock of non-performing assets (NPA) to P257.8 billion from P284.5 billion which altogether brought down the system-wide NPA ratio in end-June 2011 to 3.6% from 4.4% over a year ago.

Figure 3
Philppine Banking System Comparative NPLs/NPAs, Coverage Ratios As of End-June 2011
(In Percent)

	NPL	NPA	Coverage Ratios	
			NPL	NPA
All Banks P/	3.1%	3.6%	103.9%	56.0%
Domestic Banks P/	3.4%	3.9%	98.8%	52.8%
Private Domestic UBs	2.3%	3.4%	126.7%	56.7%
Private Domestic KBs	7.1%	5.2%	77.5%	49.9%
Government Banks	2.9%	2.3%	135.4%	84.6%
Thrift Banks	5.9%	7.6%	53.1%	33.4%
Rural Banks P/	10.4%	11.1%	48.6%	31.3%
Cooperative Banks P/	8.1%	8.0%	70.6%	52.5%
Foreign Bank Branches/ Subsidiaries	1.4%	0.9%	185.0%	171.1%
Foreign Bank Branches	0.6%	0.4%	326.7%	323.3%
Foreign Bank Subsidiaries	6.1%	4.2%	96.4%	87.6%

p/ Preliminary

Source: A Status Report on the Philippine Financial System 1st Semester 2011.

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3.3 Deposit Liabilities and Capitalisation

Deposit liabilities have been the major source of banks' funds covering 73.5% of total resources. Of these, peso deposit liabilities accounted for 78.4% of deposits in the banking system and the rest being made up of foreign currency deposit liabilities. The peso deposits posted an annual growth rate of 12.1% as of end-June 2011 and were mostly placed in shorter-term demand deposits, savings deposits and in negotiable order of withdrawal (NOW) accounts.

On the other hand, foreign currency deposits recorded some reduction to its share of total deposit liabilities on account of the general appreciation of the peso vis-a-vis the US dollar due to the extended weakness in the US financial system. It fell by 2.9% from its level in the previous year. The bulk of these deposits are placed in time deposits accounts while the remaining are in savings accounts (Figure 4).

In terms of capital, Philippine banks have remained well-capitalised with total capital accounts as of end-March 2011 amounting to P844.5 billion making up 12.0% of banks' total funds. Just to further appreciate the level of capitalisation of the banks, it is worth noting that the capital adequacy ratio of the banking system sits at 17.4% on a consolidated basis and at 16.5% on a solo basis. These are well above the minimum regulatory requirement of the BSP at 10% and of the BIS standard at 8%.

Figure 4
Philippine Banking System Deposit Mix
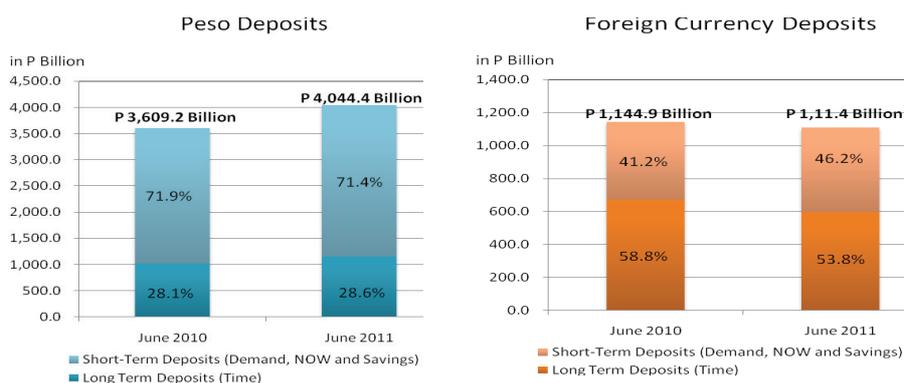
Source: A Status Report on the Philippine Financial System 1st Semester 2011.

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3.4 Profitability

Looking this time at the performance of the country's financial institutions, one can surmise that the business of banking has remained lucrative thus far. For the first semester of 2011, the net profit of banks increased by 28% to P51.9 billion from P40.6 billion a year ago, driven by the strong growth in net revenues of universal and commercial banks which posted a solid 23% increase from year ago levels and by the remarkable 144% growth in the net profits of thrift banks to P4.4 billion. These robust profits of universal, commercial and thrift banks more than compensate for the lackluster performance of rural and cooperative banks which together posted an 8.4% decline in net revenues to P1.2 billion.

The generally impressive performance of Philippine banks is likewise reflected in the profitability ratios of the industry as banks are able to give their shareholders annualised return-on-assets (ROA) of 1.5% also in the first half of 2011. This is much higher than the 1.3% posted in the same period last year. Annualised return-on-equity (ROE) similarly improved at 13% from the year ago rate of 11.2%.

A huge contributor to banks' revenue came from net interest income which grew by 7.0% as of end-June 2011 and from a reduction in interest expenses on deposits which contracted by 2.4% due to the general decline in benchmark interest rates. Banks were also able to improve their efficiency by lowering their operating expenses, hence, resulting to better cost-efficiencies. The annualised cost-to-income ratio of the banking system improved to 63.2% from 64.5% of the previous year and was a reflection of the improvement in efficiency across all categories of banks.

3.5 Contingent Claims Analysis (CCA) Model

Noting the vibrant, sound, and profitable state of the Philippine banking system we would attempt to have an understanding of the risk characteristics of the biggest private financial institutions in the industry. In order to do this, an approach known as contingent claims analysis[15] will be used to provide us a measure of the default risk of a financial institution based on the movements in the value

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15. A technical note is provided in Annex A for those interested in the mathematical concept behind the model.

of its liabilities and traded equity. We will then examine the risk of the financial institutions at an aggregate level. We begin by providing first a general description of the CCA model.

3.6 The CCA Approach[16]

The CCA model rests on the notion that a contingent claim is any asset whose payoff in the future is contingent on the values of other assets. Essentially, it provides a methodology to combine balance sheet information with widely used finance and risk management tools to construct marked-to-market balance sheets that better reflect underlying risk. The risk adjusted balance sheets use option-pricing methods developed by Black-Scholes and Robert Merton to value the debt of a firm which are modeled as a claim on assets of the firm whose value moves randomly over time.

Meanwhile, contingent claims balance sheets are balance sheets based on the contingent claims relationships where the total market value of the firm's asset is equal to the market value of liabilities. The liabilities consist of senior and subordinated claims (debt) and the junior claims (equity). But because the value of the firm's assets moves randomly over time, it has a chance of declining to or below a threshold called the default barrier. As the value of total assets decline relative to the default barrier, the chance of a firm experiencing default increases.

The main output of CCA is an estimated probability of default that is a function of the capital structure of the balance sheet, the volatility of asset returns, and the current asset value. Since the information contained in the firm's balance sheet and equity price can be translated into a probability of default, the CCA has underpinned the development of credit risk and risk management techniques.

3.7 Distance to Distress and Probability of Default[17]

Two useful credit risk indicators arise from the implementation of the CCA. These are the distance-to-distress and probability of default. The option pricing formulas applied in the CCA to estimate credit risk rely on only a few select variables: the value and volatility of equity, the distress barrier, the risk-free interest rate, and time.

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16. Gray, Dale F.; Merton, Robert C. and Bodie, Zvi, (2003), *MF Risk Working Paper*, Vol. 1-03.

17. Gapen, Michael, et al., (2004), *IMF Working Paper*, pp.8.

These variables can be combined into a measure of default risk, called the *distance-to-distress*, which computes the difference between the implied market value of firm assets and the distress barrier scaled by one standard deviation move in firm assets. In the application of the CCA to actual firm capital structures, most practitioners compute the *distress barrier* as the sum of the book value of total short-term debt and one-half of long-term debt plus interest on long-term debt.

This computation is used since historical instances of firm defaults have shown that it is possible for the value of firm assets to trade below the book value of total debt for significant periods of time without a default if most of the debt is long-term. Short-term debt is more binding since the firm faces rollover risk in a short period of time.

The distance-to-distress combines the difference between assets and distress barrier with the volatility of assets into one measure, which yields the number of standard deviation of asset value from distress as shown in Equation 1.

Equation 1

$$\text{Distance to Distress} = \frac{(\text{market value of assets} - \text{distress barrier})}{(\text{market value of assets})*(\text{asset volatility})}$$

The numerator – measures the distance between the expected one-year ahead market value of firm assets and the distress barrier. This amount is then scaled by one-standard deviation more in firm assets. *Lower market value of assets, higher levels of leverage, and higher levels of asset volatility* all serve to decrease the distance to distress.

The final step is to estimate the probability of default which consists of mapping between the distance to distress measure from the equation above and actual probabilities of default based on historical data.

3.8 Risk Assessment of Selected Philippine Banks Using the CCA Approach

At this point, we choose to apply the CCA at the individual bank level and aggregate the result of each bank to have a measure of financial vulnerability at a group level. In particular, we collect balance sheet information of nine (9) banks in the Philippines whose equity is publicly traded and which have readily accessible data series.

We used quarterly data beginning 2004Q1 to 2011Q2 for balance sheet accounts such as short-term debt, long-term liabilities, shares of stock that are outstanding and the market prices for these shares extending over 30 consecutive quarters. With this information, we derive each bank's market capitalisation and subsequently compute the distress barrier.

Next, using a measure of asset volatility we employed Equation 1 above and solved for the values of the 'distance-to-barrier' or 'distance-to-distress'. Then, the probability of default for each bank was generated and weighted according to the implied market values of their assets to finally derive a group level measure of default probability. The analysis of the results follows:

3.9 Distance-to-Distress

A graph of the market value of assets combined for the 9 banks in the sample relative to their distress barrier is shown in Figure 5. The horizontal axis shows the MVA (market value of assets) in US$ billions while the horizontal distance between the MVA and the distress barrier refers to the measure of distance-to-distress. As can be seen, the gap between the MVA and the distress barrier has been widening since 2004 up to end of 2007 where the lines seemed farthest apart. From then on, the distance-to-distress started to narrow with MVA values plummeting from a high of US$25 billion in 2007Q4 to US$15 billion in 2009Q1, or equivalent to a US$10 billion drop in a stretch of 5 quarters.

Figure 5
Assets Relative to Distress Barrier
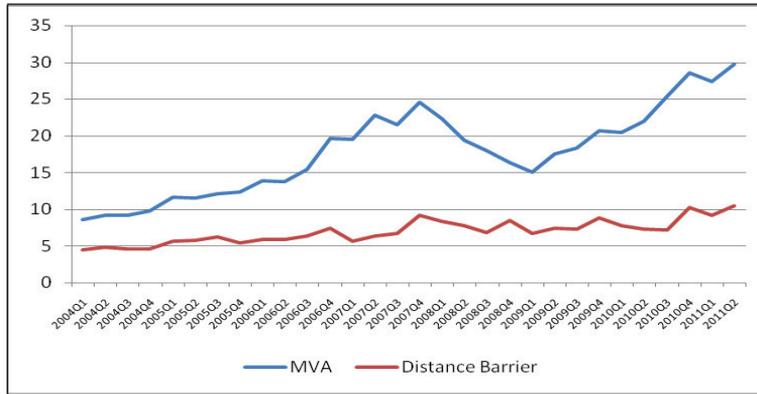
Source: Computed by the author using Bloomberg data.

The narrowing of the distance-to-distress may have been attributed to the sell-off in the local stock market resulting from the financial crisis in the US that spread over Europe and the heightened risk aversion that followed. Beginning the 2nd quarter of 2009, evidences of slow global recovery have started to restore confidence in the financial market. This brought a slow pick up in stock prices and later a more robust resurgence, thus, widening the distance-to-distress eventually to their farthest over the period covered.

Figure 6
Distance-to-Distress
1st Quarter 2004

Source: Computed by the author using Bloomberg data.

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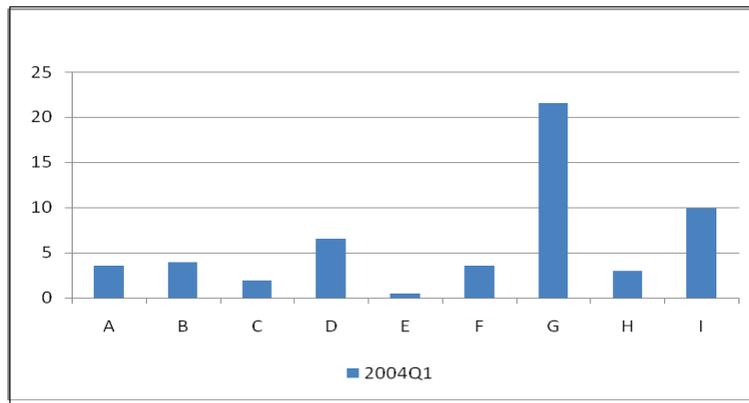
Individual banks' own distance-to-distress for the period 2004Q1 are pesented in Figure 6 and similarly for the period 2011Q2 in Figure 7. What is noticeable between the two graphs was the significant increase in the distance-to-distress for Bank E from 2004Q1 to 2011Q2. An examination of the balance sheet data for Bank E showed that the bank made a significant stride in reducing its short-term debt between the 3rd quarter and 4th quarter of 2006. From then on, it managed to keep its short-term debt at levels much lower than the period prior to 3rd quarter of 2006. This possibly explains the remarkable improvement in Bank E's distance-to-distress.

Figure 7
**Distance to Distress**
2nd Quarter 2011
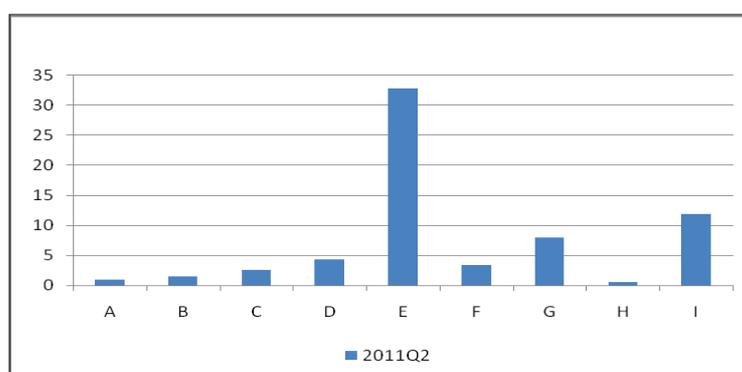
Source: Computed by the author using Bloomberg data.

Another noticeable change can be seen for Bank G. From a high level of distance-to-distress in 2004Q1, the credit risk indicator of Bank G was significantly reduced as shown in 2011Q2. This may be due partly to the higher long-term debt accumulated by Bank G over the period as well as to the increased level of volatility in assets which the bank experienced. Finally, the distance-to-distress for Banks A, B, C, D, H and I generally declined. The higher levels of asset volatility in 2011Q2 compared to 2004Q1 can perhaps explain the narrowing of the distance-to-distress observed for these banks.

The group distance-to-distress, weighted by the implied assets of individual banks, is also presented in Figure 8. One can observe that the indicator followed a general downward trend except for occasions of slight reversals. Few of these happened in the 4th quarters of 2006 and of 2008. These slight reversals coincided with the robust performances in the stock market in those period although they did not persist to an uptrend. The more recent upswing can be traced in the 4th quarter of 2010. This one is interesting to track. Whether it will boost the banks' distance-to-distress farther out or not certainly depends on the performance of equity market and the volatility of the prices of these assets over subsequent periods.

Figure 8
Group Distance-to-Distress
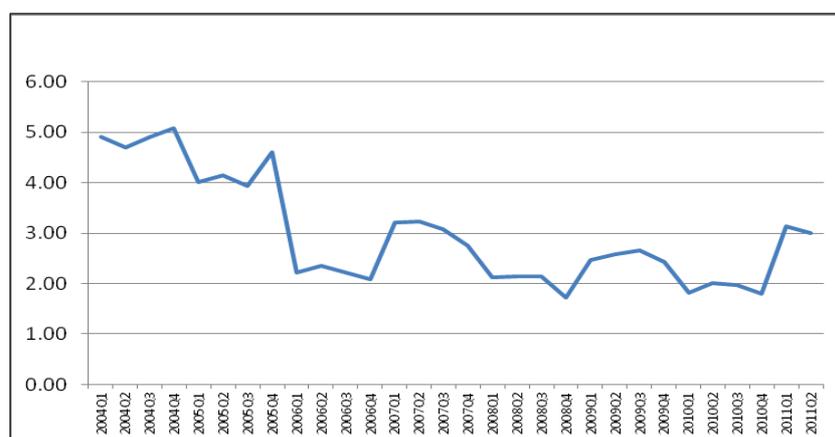
Source: Computed by the author using Bloomberg data.

3.10 Default Probability

To obtain a group-wide risk indicator of default risk, the 9 individual bank's default probability is again weighted by the implied asset values of each bank. This is shown in Figure 9. As can be observed, the aggregate default probability has been in downtrend since 2004Q1 although there were significant spikes upward in two separate periods. The first was between 2006Q4 and 2007Q2 where the risk indicator climbed steeply then fell back after 3 quarters. The next was between 2008Q4 and 2009Q4 where the group-wide default probability rose steeply, stayed at elevated levels for 4 quarters before receding back towards their lowest levels until 2010Q4.

A graph of the default probabilities of individual banks were also shown in Figure 10 alongside the group-wide default probability named as Bank Z in the graph. The evolution of the default probabilities of the majority of banks in the sample appeared to have followed the general path of the group-wide default probability except for a few which presented some interesting risk behaviours. We divided the 9 banks into 3 groups to better understand the individual banks' risk dynamics. These are highlighted in the graphs that follow.

A key risk feature of Banks A, B, and C as shown in Figure 11 is that their default probabilities are much lower than the group-wide risk indicator. There may have been a slight increase in the probability of default for Bank C in the period from 2006Q4 to 2007Q4 but this bordered nowhere near a 1% chance of defaulting.

Figure 9
**Group-wide Default Probabilities of Selected Philippine Banks**

Source: Computed by the author using Bloomberg data.

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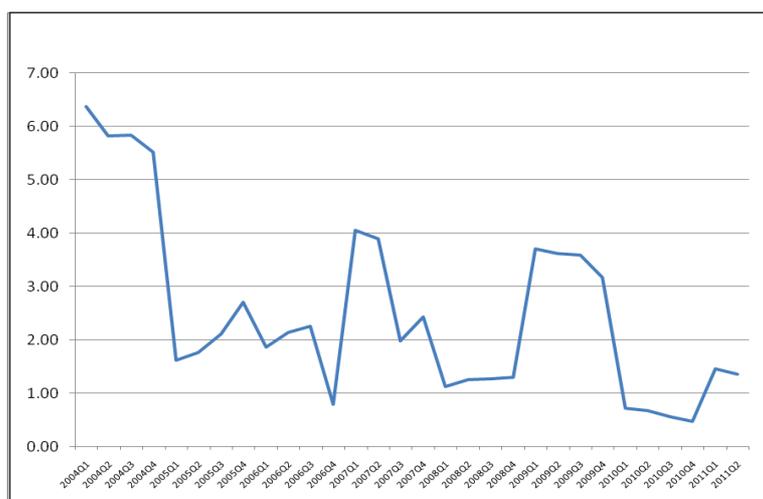
Figure 10
Group-wide and Individual Default Probabilities
of Selected Philippine Banks
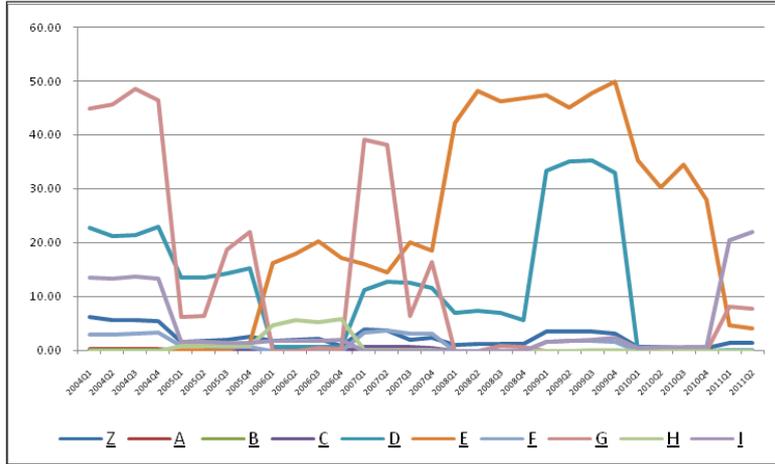
Source: Computed by the author using Bloomberg data.

Figure 11
Default Probabilities of Selected Philippine Banks


Source: Computed by the author using Bloomberg data.

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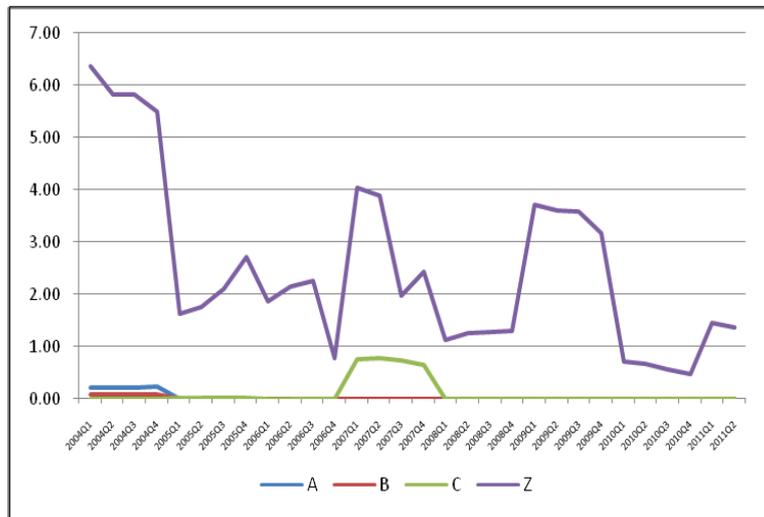
Banks D and E in Figure 12 have default probabilities that are much more pronounced than the previous group and are way above the indicator of group-wide risk. Bank E in particular exhibited a spike in riskiness starting 2005Q3 to nearly 20% and stayed around that range until 2007Q4. After which, its riskiness magnified to a near 50% default probability which peaked in 2009Q4 before it sharply declining to below the 5% level. On the other hand, Bank D similarly exhibited heightened level of riskiness characterised by a sharp spike in its chances of default around 2008Q4 and hitting the more than 30% default probability. Its risk indicator remained at elevated levels for 4 consecutive quarters before its riskiness finally dropping to an almost zero chances of default.

Finally, Banks G, H, and I which are the last group in the sample showed an equally interesting risk evolution. Bank G in Figure 13 marked a significant increase in default probability starting 2006Q4 though the experience lasted only for 2 quarters after which there was a remarkable reduction in its default risk.

What appeared striking in the graph, however, is the resurgence in the riskiness of Banks I and G beginning 2011Q4. Although, these may not be a cause for worry at this early, it pays to observe how these banks' risks would evolve in succeeding periods.

Figure 12
Default Probabilities of Selected Philippine Banks
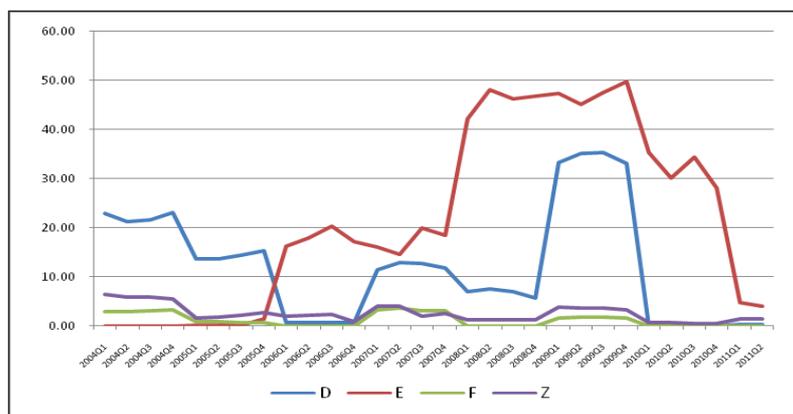
Source: Computed by the author using Bloomberg data.

Figure 13
Default Probabilities of Selected Philippine Banks
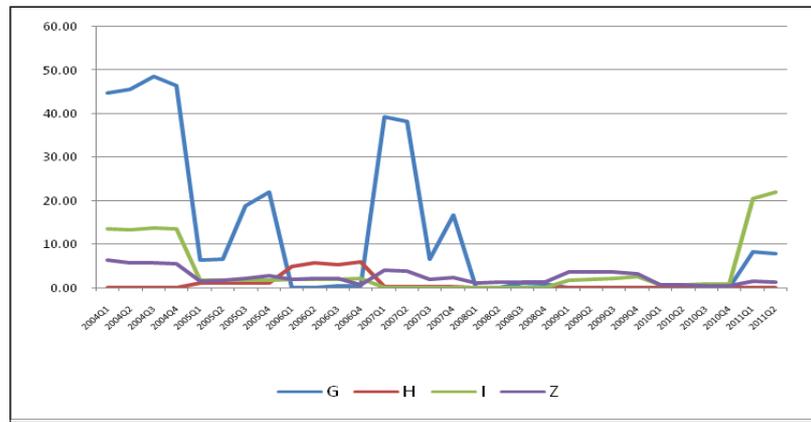
Source: Computed by the author using Bloomberg data.

4. VAR Approach to Default Risk Indicators and Select Macro Variables

Having estimated some indicators of macro financial risk, a reasonable next step is to perform a policy experiment to develop detailed empirical models linking macroeconomic variables with the outputs of the microfinance models such as CCA. The vector autoregression (VAR) modeling is a natural setting for conducting such empirical studies.[18]

For this exercise we shall be using the risk indicators obtained at the sector level that are built up from the individual CCA models of the banks used in the sample. This approach treats the CCA of the 'industry' sector of banks as if it were one large firm although one clear disadvantage of this process is that it may be possible for individual firm weakness to be covered up in the aggregation process. Nevertheless, the aggregation process should at least be indicative of possible systemic vulnerabilities of the banking 'industry'.

VAR is used for this purpose to generate the impulse response functions (IRF) of the risk indicators to shocks in selected macro variables. In particular, we would like to model a bivariate VAR first for default probability and bank

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18. Gray, Dale and Malone, Samuel, (2009), *Microfinancial Risk Analysis*, pp. 215.

leverage, then for default probability and the ratio of non-performing loans[19]. Subsequently, we model another bivariate VAR for distance-to-distress and the stock market index. The data we used for the VAR estimation are quarterly data spanning the period 2004Q1-2011Q2, then we estimate sets of bivariate VARs. Before proceeding, the time-series properties of the variables were first determined specifically for presence of non-stationarity.

The Augmented Dickey-Fuller (ADF) test is used to check for the presence of unit roots or non-stationarity. The results of the ADF test indicate that only the variable Distance-to-Distress has a unit root, so we applied first differencing and subsequent test reveals that the series has become stationary at the 5% level. Then using the Akaike and Schwarz information criteria, we have selected lag of order we tested the VAR model using the lag of order 4 for the first 2 sets of bivariate VAR estimations and a lag of order 2 for the next.

5. Empirical Results

Appendices 1.1 and 1.2 display the impulse-response functions. We take particular interest on the cross-variable impulse response of default probability with leverage in Appendix 1.1 and of default probability with non-performing loan ratio in Appendix 1.2. As can be seen, the response of default probability to leverage is immediate and moving upwards up until the 4th quarter where it reaches a peak. Generally, higher debt accumulation increases the riskiness of a firm and it is evidently true for financial institutions as in this case.

On the other hand, the response of default probability to an innovation in non- performing loan ratio takes time to take effect and is not felt until the 4th quarter. It peaks in the 5th quarter and stayed there for another quarter before eventually subsiding. As we are all aware, when non-performing loans are not collected they are eventually written off and are charged to banks' capital. Since this certainly puts to risk the solvency of banks, higher levels of non-performing loans magnify the default risk of financial institutions.

Appendix 1.3 shows another impulse response functions and of interest is the cross-variable impulse response of distance-to-distress on an innovation in the stock market index. From the figure, the response of the distance-to-distress to a shock in the stock market is felt around the 3rd quarter which persisted for

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19. NPL ratio refers to the ratio of non-performing loans (NPL) to total loans (gross of allowance for probable losses), inclusive of interbank loans.

subsequent periods then decays smoothly over time. The positive response of distance-to-distress is not surprising since higher values of stocks increase the distance-to-distress for firms, and increases the value of their assets which widens the gap of these firms' assets from the distress barrier.

With the use of the vector autoregression and its impulse response function analysis, we have shown that the aggregate risk indicators of financial institutions (i.e. the default probability and the distance-to-distress) when paired with macro-variables, can be useful tools for analysing systemic risk vulnerabilities.

6. Current Efforts at Macro-prudential Framework

Using the CCA methodology, we gained some understanding of the evolution of the default risks of banks both individually and collectively. Extending the analysis to find inter-linkages between the banks' risk indicators and the select macroeconomic variables, we found evidences that changes in conditions of macro-variables also alter the risk characteristics of banks. While the limited scope of this study did not fully capture the sector wide risks of the Philippine banks, the application of the CCA allowed us to examine bank risks at a more micro level and to appreciate the potential of the model as a tool for analysing the effects to the banking sector of certain macro conditions. This should encourage us to further the analysis to different sectors of the economy towards a more holistic picture of macro-financial risks.

The task of ensuring the stability of the financial system is complex and arduous. It demands a holistic framework for a systematic coordination of activities and deployment of policy instruments. Although there is no singular macro-prudential model applicable across countries' financial systems, there can be shared elements for developing a macro-prudential framework.

One common requirement involves the granting of certain power to a macro-prudential authority which may be a committee or a standalone agency of a central bank. These powers allow the authority to undertake certain activities and to use certain policy instruments to attain certain goals. Attaining these goals will help it to achieve an objective such as having a low probability of financial disruptions in the economy.[20] And a key ingredient to success is to

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20. Borio, Claudio, (2009), Financial Stability Review No. 13, Banque de France, September 2009.

leverage the comparative advantage of the various authorities involved while ensuring a sufficient degree of operational independence from the political process (Cummings, 2010).

In this context, the Philippine financial authorities have by far made significant strides. Already, the BSP has begun laying down the foundation for the creation of a Financial Stability Coordination Council. This council puts together the BSP and all the other financial regulators (Securities and Exchange Commission, Insurance Commission, and Deposit Insurance Corporation) and the National Government in one multi-sectoral body which will closely coordinate policies pertinent to a financial stability agenda.[21] Although as early as July 2004, a voluntary interagency body called the Financial Sector Forum (FSF) has already been in existence providing an institutionalised framework for coordinating the supervision and regulation of the country's financial system. The FSF coordinates the regulatory and supervisory policies by the different financial regulators.

Within the central bank, a high-level Financial Stability Committee (FSC) has been created on September 2010. Chaired by the Governor of the BSP with all its 3 deputy governors and 3 other senior officials as members, the FSC is tasked with defining "the appropriate market vision and work plan to adequately mitigate the build-up of systemic risk under a Financial Stability objective."[22] The establishment of this committee consequently creates a higher level of authority that will provide policy direction for financial stability, thus, reinforcing the regulatory, supervisory and examination functions of the BSP.

Another important element of a macro-prudential framework is the activities undertaken and the policy instruments deployed by the macro-prudential authority. The key activities include data collection, surveillance of the financial sector, analysis, stress-testing of the sector and risk assessment. Based on these activities and given its goals, the macro-prudential authority uses the policy instruments at its disposal which can typically take the form of macro-prudential instruments, advice on policies to individual regulators or to the government, and warnings to regulators or financial system participants.

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21. "Contemporary Challenges to Monetary Policy", an Opening Remarks Delivered by Governor Amando M. Tetangco, Jr. at the BSP International Research Conference held at Manila Peninsula Hotel on 28 February 2012.

22. See the discussion about the Philippines in the Annex section of the BIS Paper on "Central Bank Governance and Financial Stability", May 2011.

At the BSP, the Supervision and Examination Sector (SES) serves as the supervisory arm performing the supervision and periodic examination of all banking institutions and non-banking financial institutions with quasi-banking functions. It adopts a consolidated approach to supervision that complements a risk-based approach to examination. Specifically, it undertakes the examination of BSP's supervised institutions both on-site – determining if the institution is conducting its business on a safe and sound basis, and offsite – monitoring the financial performance of supervised entities in between on-site examinations.

The supervisory framework that the BSP has put in place is a potent mechanism for the central bank to identify emerging risks or vulnerabilities in its supervised institutions early on. When a bank is found to be in the early stages of non-compliance with standard conditions, the BSP through the SES enforces a prompt corrective action seeking to restore a problem bank to normal operations within a reasonable period of time. This approach helps contain the possibility of further deterioration in the financial health of a problematic bank.

On top of these, the BSP implements an array of prudential regulatory standards that are continuously strengthened and aligned with international norms to promote good corporate governance, greater transparency and reduce moral hazard.[23] Among these is the BSP's adoption of a risk-based capital adequacy framework for banks conforming to the recommendations of the Basel Committee on Banking Supervision for international capital standards. The BSP likewise enforces the adoption of an internal capital adequacy assessment process (ICAAP) for universal and commercial banks.[24]

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23. See Updates on BSP Supervision and Regulation of the Supervisory and Examination Sector, March 2011.

24. The ICAAP refers to the process carried out by banks in determining what they think is the appropriate level of capital to hold. Under the guidelines banks should consider a number of factors in their assessment, among others, their risk profile, their business plan, and possible changes in the operating environment. The risk assessment must consider risks not captured by the current capital framework such as credit concentration risk and those posed by contingent exposures. Banks must also support any expansion plans and weather downturn in the market. Other considerations may include external rating goals and market reputation.

In the area of deposit taking operations, banks are required to set aside 18% reserves for their deposits and deposit substitute liabilities.[25] Those authorised to accept government deposits are required to comply with a liquidity floor requirement. Furthermore, those authorised to accept foreign currency deposits, must maintain a 100% cover on the foreign currency liabilities as well as a 30% asset cover. When it comes to lending operations, a single borrowers' limit (SBL) of up to 25% of the net worth of a bank is in place for its credit accommodations and guarantees. There is also a DOSRI limit imposing individual and aggregate ceilings as well as lending limits on banks' or quasi-banks' subsidiaries and affiliates. And there is a prescribed ceiling on commercial banks' loans to the real estate sector equivalent to 20% of its total loan portfolio. [26]

This 'defence in depth'[27] or the layers of oversight, prudential regulations and activities related to the supervision and examination of financial and non-banking financial institutions has enabled the BSP to coordinate timely responses to emerging problems in supervised institutions. This contributed markedly in keeping the soundness and stability of the banking system as well as the country's financial system.

7. Policy Recommendations

From the elements required for a macro-prudential framework, the BSP's current efforts at developing its own framework appear in step with the emerging trends in financial regulations. It has successfully coordinated with the other regulators of the financial system towards forming a cohesive front for identifying and managing the potential build up of risks emanating from their supervised institutions.

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25. This is a recent amendment to an existing regulation entitled the "Unification of the Statutory/ Legal and Liquidity Reserve Requirement, Non-Remuneration of the Unified Reserve Requirement, Exclusion of Vault Cash and Demand Deposits as Eligible Forms of Reserve Requirement Compliance, and Reduction in the Unified Reserve Requirement Ratios", Circular 753 issued on 29 March 2012.

26. A detailed omnibus of BSP's existing prudential regulations can be found at the BSP's website.

27. Defense in depth is a concept familiar in information security which rests on the belief that no single measure can protect an information technology network from intrusion; rather, a combination of measures in required. The multiple layers of protection trip up an intruder, slow it down, and increase the probability of detection. See Cummings, 2010.

Having done so, the BSP must work to ensure the availability of information about the supervised entities as well as to establish the analytical capacity of the institutions involved in the performance of a macro-prudential mandate.

Towards this end, the BSP can capitalize on its linkages with its counterparties within the financial system for purposes of obtaining the data and information for the conduct of macro-prudential analysis. A memorandum of agreement may be undertaken between the BSP and members of the FSF for enhanced information sharing, data dissemination, and joint research projects. Research initiatives can be promoted through the FSF involving the creation of project teams whose members would come from any of the regulatory institutions; they would be given access to data or information for purposes of the research.

Research projects may focus on new products, new infrastructures and the interactions of the components of the financial system. These then may contribute to the development of new surveillance procedures, new analytical tools and new policy instruments. With these, the research initiatives can be an important element of surveillance, analysis and macro-financial risk assessment.

Prospectively, the BSP again through the FSF or the FSC may encourage forging of a wider macro-surveillance mechanism extending beyond national borders. It can promote policy dialogues, exchanges of lessons learned and greater interactions with and among regulators in other jurisdictions through more conferences or forum involving a broader regional participation. This should lead to better anticipation for any build up of risk in other countries which may have a spillover effect in the local financial system, subsequently, to preparedness for any stress scenario event.

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Technical Notes

1. Theoretical Concept

The Contingent Claims Approach (CCA) is a structural model based on the Black-Scholes and Merton model. Consider a case of firm with assets, V, which are financed by debt obligation, F, and Equity, E. The value of the firm's assets is simply the sum of the firm's debt and equity:

$$V_t = F_t + E_t \tag{1}$$

The value of the firm's debt obligation is also known as the default barrier, DB. The probability of default ($V_{t+1} < F_{t+1}$ or DB) exist as long as it is greater than zero. This implies that at time t+1, the market value of assets, B_t, is lower than the yield to maturity of the debt, Fe^{-rT}. In this simplified firm structure, the risk is a function of the leverage ratio, $LR = Fe^{-rT}/B_t$, the volatility of the rate of return of the firm's assets, σ_v and the time to maturity of the debt, T. Thus, for a creditor who extended a loan to this firm must purchase a put option to eliminate the risk on the loan[28]. The value of the put option, P_o, on the market value of the firm assets, B_t, for the term of the debt must have a strike price, S, equal to the face value of the loan. The creditor can completely eliminate the credit risk and convert the risky loan into a riskless loan. If the riskless interest rate is r, then in equilibrium it should be that:

$$B_t + P_o = Fe^{-rT} \tag{2}$$

In applying the Black-Scholes and Merton model, the value of the put can be written as:

$$P_o = -N(d_1) \ B_t + Fe^{-rT} N(-d_2) \tag{3}$$

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28. A put option is a contract between two parties to exchange assets for an agreed amount (strike price) at a specified future date. The buyer of the put, has the right but not the obligation to sell the asset at the strike price. The seller has the obligation to buy the asset once the buyer exercises his right.

Where P_o, is the current value of the put, N(.) is the cumulative standard normal distribution, μ is the expected return on the assets, and σ_v is the standard deviation of the rate of return of the firm's assets.

$$d_1 = \frac{\ln(\frac{B_t}{F}) + \left(\mu + \frac{1}{2}\sigma^2\right)T}{\sigma_v\sqrt{T}} = \frac{\ln(\frac{B_t}{Fe^{-rT}}) + \left(\mu + \frac{1}{2}\sigma^2\right)T}{\sigma_v\sqrt{T}}$$ (4)

$$d_2 = d_1 - \sigma_v\sqrt{T}$$ (5)

The numerator measures the distance between the expected one-year ahead market value of the firm's assets and the distress barrier. The denominator is used to scale the numerator with respect to units of standard deviations. Thus, the probability of Default, ($V_{t+1} < F_{t+1}$ or DB) is as follows:

$$\text{Probability of default} = N\left(-\frac{LN\frac{V_0}{DB} + (\mu - \frac{\sigma_v^2}{2})T}{\sigma_v\sqrt{T}}\right)$$ (6)

Using Equation (5), the expected return on assets, μ, can be computed as follows:

$$\mu = \max\left[\frac{V_{A,(t)} - V_{A,(t+1)}}{V_{A,(t+1)}}, r\right]$$ (7)

where r, is the one year Treasury Bill rate and T, is set to one year so that the probability emerging out of the assessment is the one year ahead probability of default on an *ex ante* basis.

Moreover, the equity of the firm, E_t, is itself a contingent claim on the firm's assets. Since equity holders have a junior claim on the residual value of the assets, the value of the equity can be viewed as a call option. This means that equity holders receive the maximum of market value assets minus the default barrier or nothing in case of default. Given that the firm's equity behaves like a European call option on the firm's assets, the Black-Scholes and Merton model can be used to compute the equity value. The equation for valuing equity as a European call option is:

$$E_t = V_t N(d_1) - Fe^{-rT} N(d_2)$$ (8)

2. Estimating Financial Institution Risk using the CCA

In the theoretical concept, it is shown that the Black-Scholes and Merton model can be applied to calculate risks in the financial system by showing the

distance of institutions from the default barrier and estimate the probability the default. In cases where the debt and equity are both traded, the market value of assets, *V*, can be reconstructed by adding the market values of both debt and equity as stated in Equation (1). However, practical problem arises in cases where firm debt is not traded and only equity is traded or vice versa. For this project, the data on the Top Big Banks are limited only to institutions where there are available equity prices. Since most of the participating economies are constrained by market data availability of debt, the default barrier (Fe^{-rT}) is determined as a function of the short-term debt and long-term liabilities of the firm.[29]

According to Vasicek and Kealhofer empirical model,[30] firms default when the asset value reaches a level that is somewhere between the value of the total liabilities and the value of the short-term debt. Therefore, the tail of the distribution of asset values below the total debt may not be as accurate as a measure of actual probability of default. The loss of accuracy may result from the non-normality of the asset return distribution or the firm is able to draw on lines of credit (unobservable). Thus, the default barrier is computed as the sum of short-term debt plus half of the long-term debt.

For the market value of equity, E_t, it is equal to the number of outstanding stocks multiplied by the closing stock price as of the balance sheet date. To calculate a single systemic risk indicator, an aggregation technique based on the weighted average market value of assets is used.

29. Crouhy, Michel, et al., (2001), "Risk Management," First Edition, pp. 371- 374.

30. The most popular commercial model is the KMV (Kealhofer, McQuown and Vasicek) model.

Impulse Response of Default Probability to Leverage

Response to Cholesky One S.D. Innovations ± 2 S.E.


Response of DEFAULT_PROB to DEFAULT_PROB
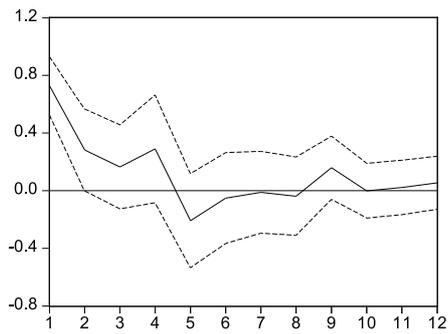
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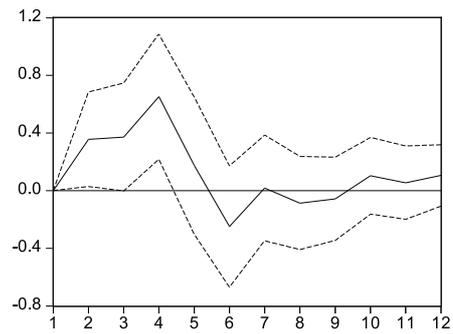
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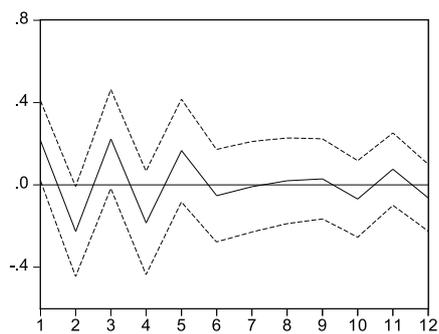
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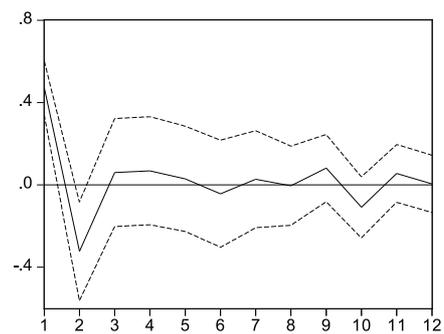
Impulse Response of Default Probability to NPL Ratio

Response to Cholesky One S.D. Innovations ± 2 S.E.

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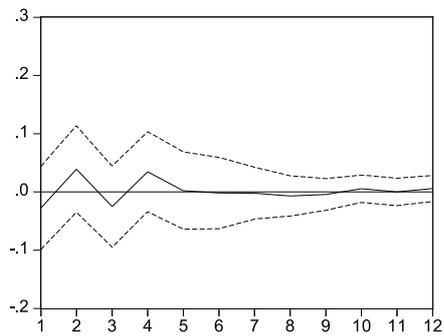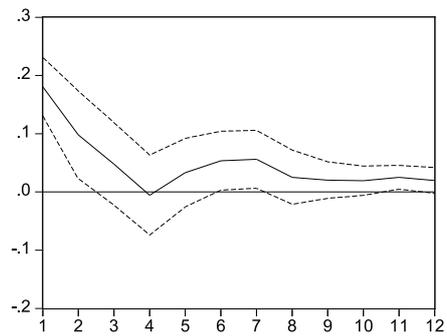
Impulse Response of Distance to Distress to Stock Market Index

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of DIST_TO_DISTRESS to DIST_TO_DISTRESS
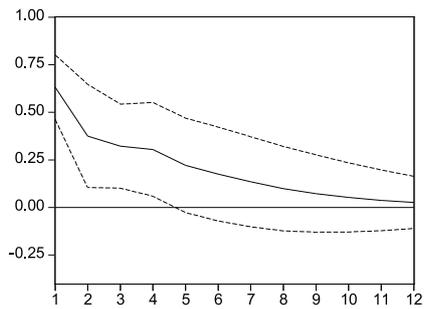
Response of DIST_TO_DISTRESS to D(PSE_INDEX)
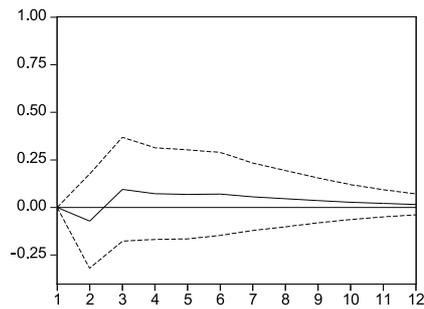
Response of D(PSE_INDEX) to DIST_TO_DISTRESS
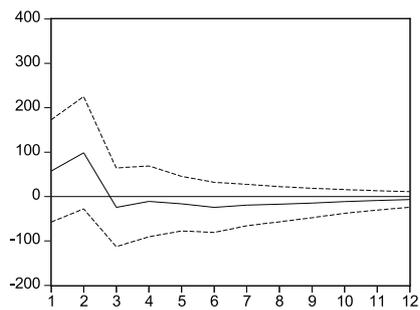
Response of D(PSE_INDEX) to D(PSE_INDEX)

172
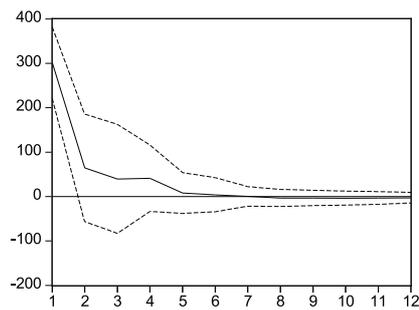
Chapter 8

A MACRO-PRUDENTIAL ASSESSMENT FOR SRI LANKA

By
Dr. Chandranath Amarasekara[1]

*"Central banks certainly did not ignore issues of financial stability in the decades before the recent crisis, but financial stability policy was often viewed as the junior partner to monetary policy. One of the most important legacies of the crisis will be the restoration of financial stability policy to co-equal status with monetary policy."*
(Bernanke, 2011)

1. Introduction

There is now broad agreement amongst central banking circles that effective central bank policy must include monetary policy, micro-prudential policy as well as macro-prudential policy to ensure price and economic stability while maintaining the stability of the financial system as the three policies would reinforce one other when used together (Borio and Shim, 2007). In contrast to monetary policy, where the objective is to ensure price stability and the objective of micro-prudential supervision, which focuses on the safety and soundness of individual institutions as well as consumer protection, the key objective of macro-prudential policy is to mitigate systemic risk, which is defined as "the risk that ûnancial instability becomes so widespread that it impairs the functioning of a financial system to the point where economic growth and welfare suffer materially" (European Central Bank, 2009). In order to identify risks to the financial system, analytical tools have been devised over time, of which early warning systems (EWS) for early identification and assessment of forms of

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systemic risk and stress tests to predict distress and assess its possible impact have proved to be two important tools to be used by central bankers regularly. (Bank of England, 2009, Caruana, 2010, Clement, 2010, Galati and Moessner, 2011 for comprehensive reviews on various aspects of macro-prudential policies.)

This paper seeks to apply the Contingent Claims Approach (CCA) as a modern market based macro-prudential indicator to measure the probability of default of commercial banks in Sri Lanka. The method, that was initially developed by Black and Scholes (1973) and Merton (1973, 1974), assesses the ability of a firm (or the banking system) to honour its debt obligations given the value of its assets at a given period in time. The three principles that govern the analysis are as follows: (i) the value of liabilities flows from assets, (ii) liabilities have different seniority, and (iii) there is a random element to the way asset value evolves over time. (Gapen, et al, 2004)

As recent examples, the CCA methodology has been used by van den End and Tabbae (2005) on the Dutch banking system; Gray, et al (2008) on the Chilean banking system; Lewis (2010) in the measurement of insolvency risk and the effect of the global financial crisis on the Jamaican financial system; Antunes and Silva (2010) in the assessment of the stability of the Portuguese banking system; and Budina, et al (2011) in the explanation of the strength of the Israeli financial system amidst the global financial crisis, as well as by some researchers such as Gray, et al (2007) in the measurement and management of sovereign credit risk.

1.1 Sri Lanka – A Brief Overview

Prior to embarking on the analysis, a brief overview of the Sri Lankan economy could be useful to the reader. The analysis focuses on the period from the year 2000 to 2010, and by the end of this period Sri Lanka has graduated from a low income economy to a lower middle income economy with a per capital GDP of US$2,399. Since early 1980s, the Sri Lankan economy lagged behind the global economy mainly due to the internal armed conflict. Several episodes of cessation of hostilities between the warring parties were observed during 2000s, and the Sri Lankan government forces annihilated the menace of terrorism in May 2009. Since then, the economy has witnessed a remarkable recovery with economic growth rates of over 7% recorded continuously in each quarter, and a GDP growth rate of 8% was witnessed in 2010 with contributions from all sectors as well as all regions. (This growth momentum continued in the year 2011 with provisional estimates indicating a growth rate of over 8% for the year.) The annual average inflation has continued to remain low at single digits

for a considerable period of time, with improved domestic supplies. The exchange rate has been largely stable in 2010 and 2011 while the budget deficit and public debt as a percentage of GDP have been improving continuously since the end of the conflict. The capital markets improved substantially, with the Colombo Stock Exchange (CSE) being named one of the best performing stock markets in the world in 2010. With low and stable interest rates, broad money growth and credit extended to the private sector by commercial banks, which had slowed down substantially in 2009, picked up and recorded robust growth in 2010 and thereafter.

Sri Lanka's financial sector is regulated by the Central Bank of Sri Lanka (CBSL), Securities and Exchange Commission (SEC), and Insurance Board of Sri Lanka (IBSL). The Central Bank regulates and registers licensed commercial banks (LCBs), licensed specialised banks (LSBs), registered finance companies (RFCs), and specialised leasing companies (SLCs). According to the Monetary Law Act, which governs the operations of the Central Bank of Sri Lanka, the bank has two core objectives, namely, (a) maintaining economic and price stability and (b) maintaining financial system stability, with a view to encouraging and promoting the development of the productive resources of Sri Lanka. These objectives have necessitated the Central Bank to be responsible for the conduct of monetary policy, micro-prudential as well macro-prudential policy in the country.

2. Elements of Macro-prudential Policy Framework

As explained in the Financial System Stability Report (2010) and the Central Bank of Sri Lanka Annual Report (2010), the Central Bank conducts macro-prudential surveillance to identify systemic risks to the financial sector and to assess its capacity to withstand such threats. This involves the analysis of macroeconomic and financial market developments and the risk exposures of banking and other financial institutions. A comprehensive set of aggregate Financial Soundness Indicators is compiled on a periodic basis to monitor the health of key financial institutions, while work has also been initiated to develop a database on corporate sector borrowers to assess their financial strength and debt repayment capacity, which can be developed into a network analysis of macro stress testing.

Figure 1
Banking Soundness Index (2006Q3=100)
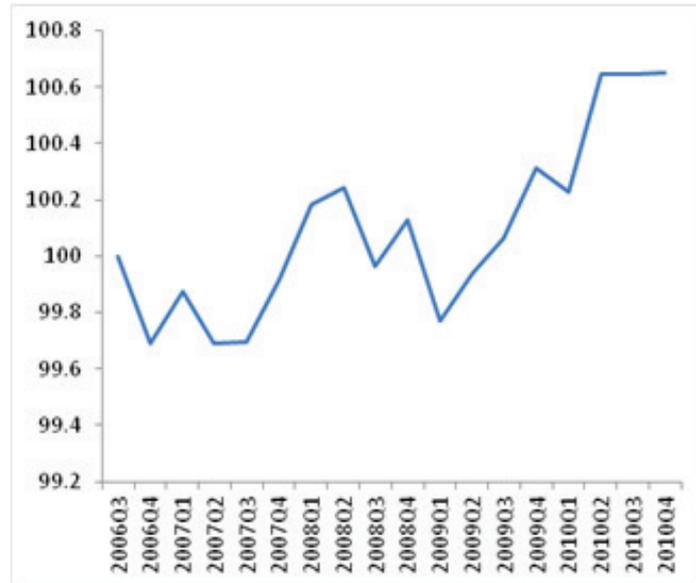
The Banking Soundness Index (BSI, base: 2006Q3=100) published by the Central Bank of Sri Lanka indicates that the soundness of the banking sector has been stable and sound over the medium term. The BSI is based on selected financial soundness indicators representing capital, asset quality, profitability, liquidity and sensitivity to market risk. The financial indicators are weighted based on the market share of each bank. The Central Bank conducts regular stress tests on banking institutions and the banking sector to assess their capacity to cope with extreme but plausible shocks and these also indicate that currently the banking sector is resilient to withstand shocks.

3. Macro-Prudential Policy Objectives, Instruments and Intervention

As explained earlier, the prime objective of macro-prudential policy is to limit the systemic risk addressing risks arising within and amplified by the financial system. In recent years, the possible need for the implementation of macro-prudential policies in Sri Lanka can be discussed at least in relation to three instances. First, with global easing of monetary conditions due to persistent economic and financial crisis, and resultant foreign capital movements, excess

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liquidity in domestic money markets in the Asian economies increased rapidly. Sri Lanka was also no exception to this trend in 2010 and early 2011. Excess liquidity conditions can result in excessive credit growth, and monetary policy needs to be tightened in order to avoid the adverse effects of high excess liquidity. However, if only few banks hold excess liquidity, then monetary policy tightening itself may affect the entire banking system adversely, and implementing macro-prudential policies such as imposing higher reserve requirement only on banks which hold excess liquidity may be a policy option that could have been considered by the Central Bank of Sri Lanka. The second such example relates to the high growth of credit extended to the private sector by commercial banks. Again, conventional monetary policy toolkit advocates tightening of monetary policy, but if the excessive credit is created by a few banks, the Central Bank of Sri Lanka could consider using macro-prudential policies to address credit creation by these banks while ensuring that overall credit growth is at desirable levels. The third instance is the recent rapid increase in credit granted in pawning of gold jewellery. Although commercial banks consider pawning as low risk credit, the future riskiness depends on gold price movements in the international market, and pawning activity may need to be streamlined by using macro-prudential policies to ensure continuous soundness of the banking system.

The Central Bank of Sri Lanka uses a mix of policy instruments to achieve its objectives. In terms of banking soundness, recent examples of policy tools include, requiring licensed banks to increase their capital on a staggered basis to support the growth momentum of the economy and to have enough buffers to mitigate risks, imposing general provision on performing and selected categories of loans and advances to mitigate credit risk in addition to specific provision requirements, imposing limits on bank exposure to stock market activities by placing limits on margin trading and issue of guarantees for IPOs to promote the safety and soundness of the banking system, and requiring banks to adopt appropriate risk management standards to mitigate risks arising from possible volatility and price bubbles of assets. In addition, the recent monetary policy decision (February 2011) to raise the policy interest rates and to limit bank-wise year-on-year credit growth to a range of 18-23%, can be seen as a mix of policy tools in ensuring monetary stability, external sector stability as well as the stability of the financial system.

4. Methodology: Framework for Assessing Systemic Risk of Major Financial Institutions[2]

4.1 Theoretical Concept

The Contingent Claims Approach is a structural model based on the Black-Scholes and Merton model. Consider a case of firm with assets, V, which are financed by debt obligation, F, and Equity, E. The value of the firm's assets is simply the sum of the firm's debt and equity:

$$V_t = F_t + E_t \tag{1}$$

The value of the firm's debt obligation is also known as the default barrier, DB. The probability of default ($V_{t+1} < F_{t+1}$ or DB) exist as long as it is greater than zero. This implies that at time t+1, the market value of assets, B_t, is lower than the yield to maturity of the debt, Fe^{-rT}. In this simplified firm structure, the risk is a function of the leverage ratio, $LR = Fe^{-rT}/B_t$, the volatility of the rate of return of the firm's assets, o_v, and the time to maturity of the debt, T. Thus, for a creditor who extended a loan to this firm must purchase a put option to eliminate the risk on the loan[3]. The value of the put option, P_o, on the market value of the firm assets, B_t, for the term of the debt must have a strike price, S, equal to the face value of the loan. The creditor can completely eliminate the credit risk and convert the risky loan into a riskless loan. If the riskless interest rate is r, then in equilibrium it should be that:

$$B_t + P_o = Fe^{-rT} \tag{2}$$

In applying the Black-Scholes and Merton model, the value of the put can be written as:

$$P_o = -N(d_1)\ B_t + Fe^{-rT}\ N(-d_2) \tag{3}$$

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2. Section 4 was compiled by the Team Leader for the collaborative Project, Mr. Eufrocinio M. Bernabe Jr.

3. A put option is a contract between two parties to exchange assets for an agreed amount (strike price) at a specified future date. The buyer of the put, has the right but not the obligation to sell the asset at the strike price. The seller has the obligation to buy the asset once the buyer exercises his right.

Where P_o, is the current value of the put, N(.) is the cumulative standard normal distribution, μ is the expected return on the assets, and σ_v is the standard deviation of the rate of return of the firm's assets.

$$d_1 = \frac{\ln(\frac{B_t}{F}) + \left(\mu + \frac{1}{2}\sigma^2\right)T}{\sigma_v\sqrt{T}} = \frac{\ln(\frac{B_t}{Fe^{-rT}}) + \left(\mu + \frac{1}{2}\sigma^2\right)T}{\sigma_v\sqrt{T}} \quad (4)$$

$$d_2 = d_1 - \sigma_v\sqrt{T} \quad (5)$$

The numerator measures the distance between the expected one-year ahead market value of the firm's assets and the distress barrier. The denominator is used to scale the numerator with respect to units of standard deviations. Thus, the probability of Default, $(V_{t+1} < F_{t+1}\ or\ DB)$ is as follows:

$$\text{Probability of default} = N\left(-\frac{LN\frac{V_0}{DB} + (\mu - \frac{\sigma_v^2}{2})T}{\sigma_v\sqrt{T}}\right) \quad (6)$$

Using equation (5), the expected return on assets, μ, can be computed as follows:

$$\mu = \max\left[\frac{v_{A,(t)} - v_{A,(t+1)}}{V_{A,(t+1)}}, r\right] \quad (7)$$

where r, is the one year Treasury Bill rate and T, is set to one year so that the probability emerging out of the assessment is the one year ahead probability of default on an *ex ante* basis.

Moreover, the equity of the firm, E_t, is itself a contingent claim on the firm's assets. Since equity holders have a junior claim on the residual value of the assets, the value of the equity can be viewed as a call option. This means that equity holders receive the maximum of market value assets minus the default barrier or nothing in case of default. Given that the firm's equity behaves like a European call option on the firm's assets, the Black-Scholes and Merton model can be used to compute the equity value. The equation for valuing equity as a European call option is:

$$E_t = V_t N(d_1) - Fe^{-rT} N(d_2) \quad (8)$$

4.2 Estimating Financial Institution Risk Using the Contingent Claims Approach

In the theoretical concept, it is shown that the Black-Scholes and Merton model can be applied to calculate risks in the financial system by showing the distance of institutions from the default barrier and estimate the probability the default. In cases where the debt and equity are both traded, the market value of assets, V, can be reconstructed by adding the market values of both debt and equity as stated in Equation (1). However, practical problem arises in cases where firm debt is not traded and only equity is traded or vice versa. For this project, the data on the Top Big Banks are limited only to institutions where there are available equity prices. Since most of the participating economies are constrained by market data availability of debt, the default barrier (Fe^{-rT}) is determined as a function of the short-term debt and long-term liabilities of the firm. (Crouhy, 2001)

Figure 2
Probability Distribution of Asset Value and the Default Barrier
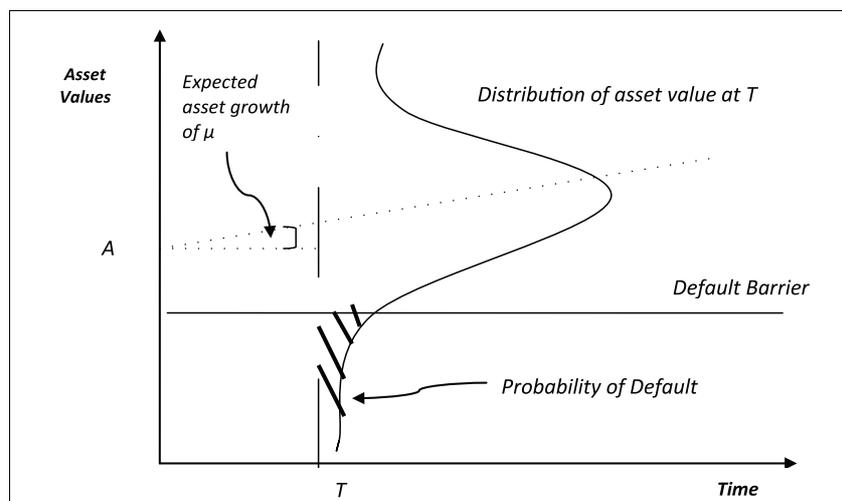
According to the Vasicek and Kealhofer empirical model,[4] firms default when the asset value reaches a level that is somewhere between the value of the total liabilities and the value of the short-term debt. Therefore, the tail of the distribution of asset values below the total debt may not be as accurate as

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4. The most popular commercial model is the Kealhofer, McQuown and Vasicek (KMV) model.

a measure of actual probability of default. The loss of accuracy may result from the non-normality of the asset return distribution or the firm is able to draw on lines of credit (unobservable). Thus, the default barrier is computed as the sum of short-term debt plus half of the long-term debt.

For the market value of equity, , it is equal to the number of outstanding stocks multiplied by the closing stock price as of the balance sheet date. To calculate a single systemic risk indicator, an aggregation technique based on the weighted average market value of assets is used.

5. Data

The choice of commercial banks for the current analysis is performed as follows: Of the 22 commercial banks in Sri Lanka as at end 2010, 11 banks are locally incorporated while 11 banks are branches of foreign commercial banks. Within the domestic banks, Bank of Ceylon and People's Bank are owned by the government. Since a crucial piece of information for the CCA methodology is derived from the share market information on individual banks, it is essential that the commercial banks chosen are listed in the domestic stock market. This criterion reduced the choice to the nine private banks, out of which the five private commercial banks listed in the Colombo Stock Exchange (CSE) before 2000 were selected for the analysis.

Figure 3
The Choice of Commercial Banks for the Analysis
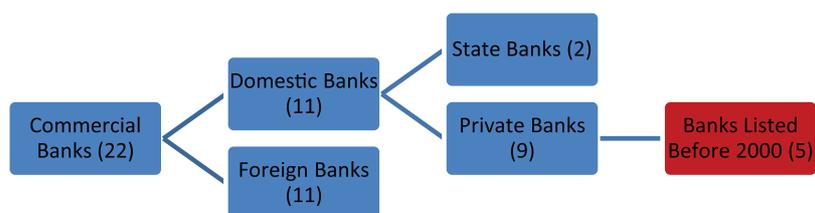
5.1 Micro Level Data

While information on outstanding shares of stock and their market price pertaining to the selected commercial banks are utilised to compute the market value of capitalisation of commercial banks, from their balance sheets, information

on their borrowings is obtained. Although the general method in this research project treats short-term and long-term debt differently in the analysis, due to the absence of a readily available breakdown of short-term and long-term debt of commercial banks, total borrowings are used instead. Data from the stock market are available daily, while the balance sheet data are available monthly, but in line with the availability of most macroeconomic data series as discussed below, quarterly data are used in computing default probabilities as well.

The process of calculating default probabilities is summarised in Figure 4 below.

Figure 4
The Process of Calculating Default Probabilities
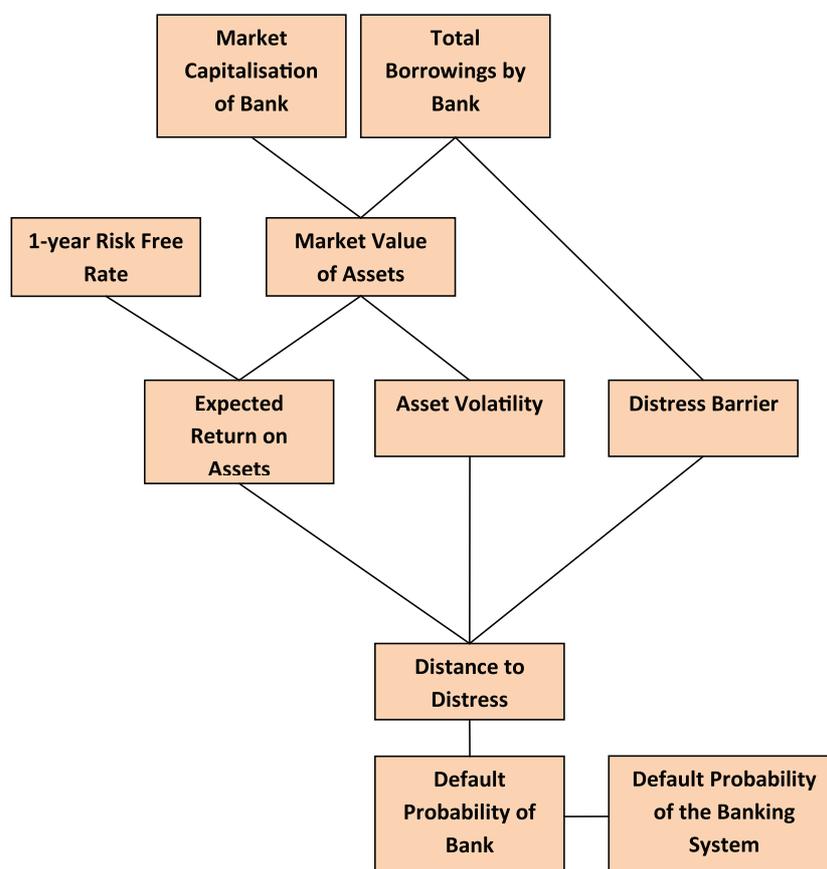
Figure 5
Summary Statistics for Default Probabilities
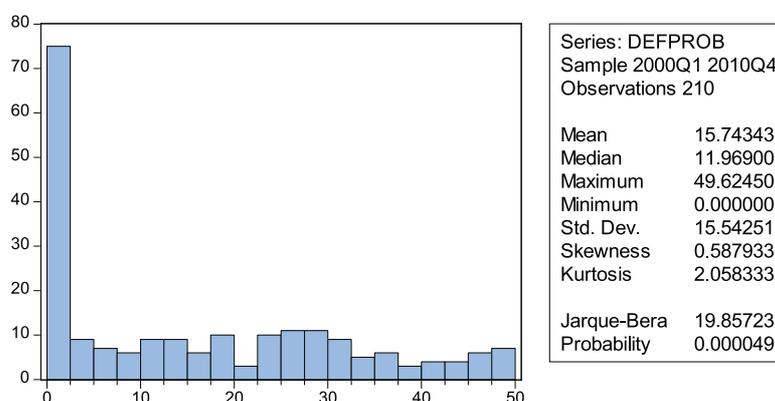
The summary statistics for default probabilities of the Sri Lankan banking sector obtained using the process discussed above are given in Figure 5. The statistics show that default probabilities have always been in the lower 50% of the probability spectrum, reporting default probabilities close to zero in most quarters. Both the mean and median default probabilities lie in the range of 11-16%, thus displaying a strong leftward skewness in the distribution.

5.2 Macroeconomic Data

Several indicators of domestic macro and micro financial conditions are used for the analysis, and these include Gross Domestic Product (GDP), Colombo Consumers' Price index (CCPI, spliced), All Share Price Index (ASPI) of the Colombo Stock Exchange (CSE), total liabilities to total assets (leverage) ratio of the commercial banking system (LIAASSRT), total capital of the commercial banking system (TOTCAP), total deposits of the commercial banking system (TOTDEP) and non-performing loans of the commercial banking system (NPL).

Figure 6
Macroeconomic Data - Levels

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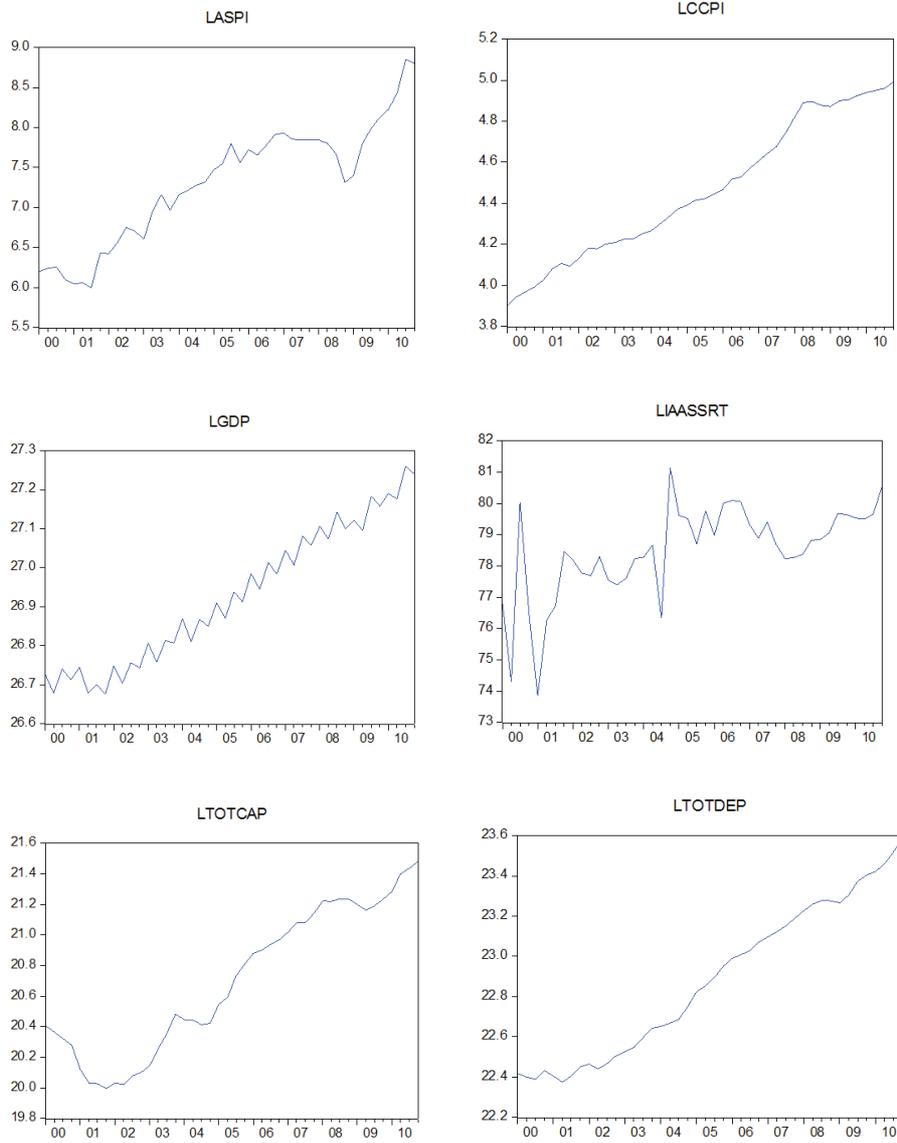
Figure 6
Non-performing Loans (Level and Ratio)
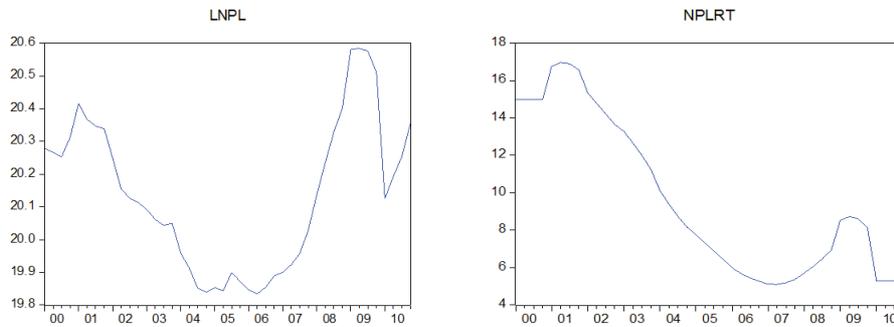
Log levels of all series are tested for unit root using Augmented Dickey Fuller (ADF) test after adjusting for seasonal factors. However, except for the liabilities to assets ratio (LIAASSRT), all other series are non-stationary at log levels. The stationarity of non- performing loans are tested both on log levels (LNPL) as well as on the non-performing loan ratio of the commercial banking system (NPLRT). While LNPL is found to be I(1), NPLRT is non-stationary at both the level and the fist difference. The details of the unit root tests are given in Table 1.

Table 1
Unit Root Tests

	Exogenous	Lag Length	Level	Exogenous	Lag Length	1st Difference
LIAASSRT	Constant	1	-3.1744	Constant		
			(0.0287)			
LTOTCAP	Constant	0	1.0555	Constant	0	**-3.6344**
			(0.9965)			**(0.0091)**
LTOTDEP	Constant	2	1.8734	Constant	1	**-5.2446**
			(0.9997)			**(0.0001)**
LASPI	Constant	0	-0.1067	Constant	0	**-6.2234**
			-0.9421			**(0.0000)**
LCCPI	Constant	1	-0.3249	Constant	0	**-4.5454**
			(0.9124)			**(0.0007)**
LGDP	Constant	5	0.9927	Constant	4	**-3.1325**
			-0.9957			**(0.0325)**
LNPL	Constant	0	-1.0946	Constant	0	**-4.6428**
			(0.7095)			**(0.0005)**
NPLRT	Constant	5	-2.3975	Constant	4	-2.0059
			(0.1492)			(0.2832)

Augmented Dickey-Fuller test statistic (Prob Value).
Automatic Lag Length Selection based on SIC, Max Lags=9.

The GDP series in Sri Lanka displays a quarterly pattern, which cannot be corrected through seasonal adjustment, and this pattern is aggravated when first differences are used, distorting results. To address this issue, as well as to ensure that the results are easily interpretable, year-on-year changes (D4) of non-stationary variables are used instead of quarter-on-quarter changes. Year-on-year changes used for the analysis are displayed in Figure 7.

Figure 7
Year-on-year Growth Rates
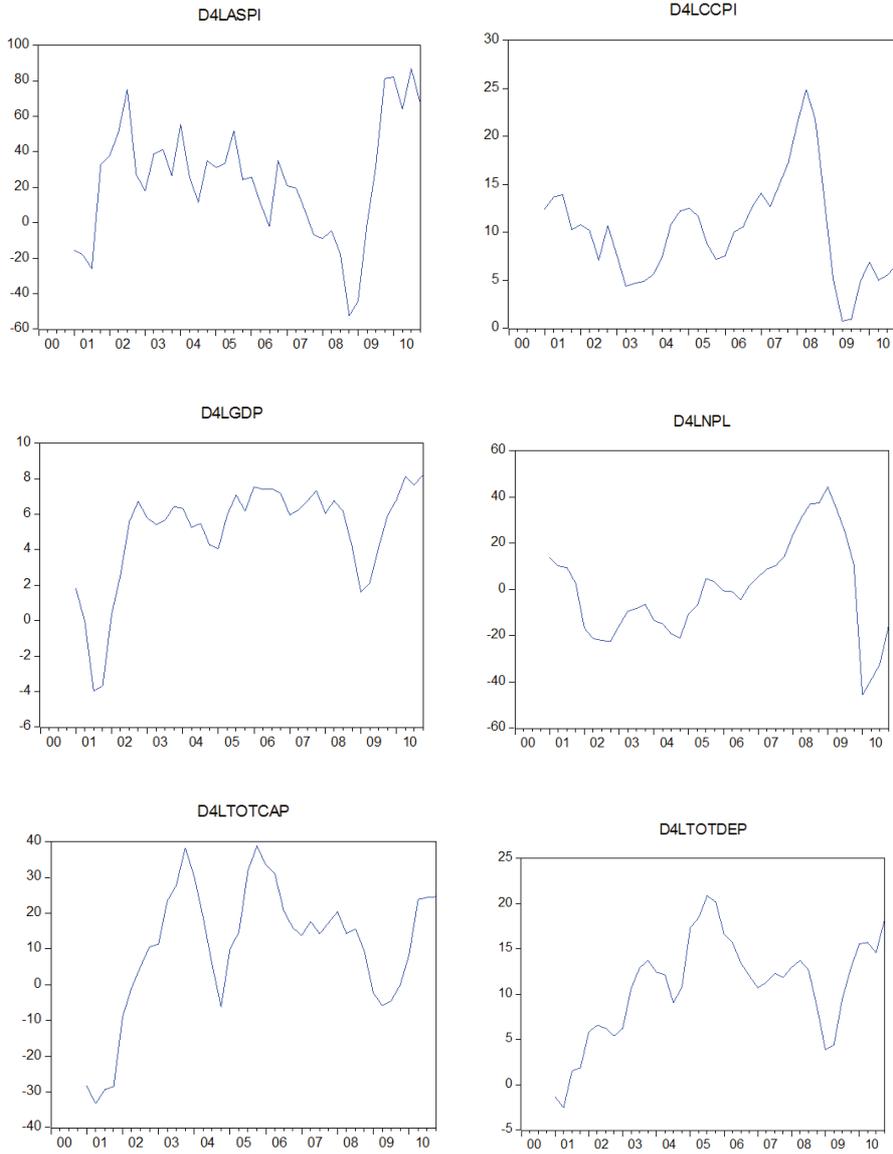
Table 2
Summary Statistics

	LIAASSRT	D4LTOTCAP	D4LNPL	D4LTOTDEP	D4LASPI	D4LCCPI	D4LGDP
Mean	78.6400	10.5657	-0.4590	10.8709	23.7593	10.0950	5.0196
Median	78.7680	14.2060	-0.8024	12.0898	26.1666	10.2231	5.9708
Maximum	81.1282	38.7536	44.3243	20.8668	86.7577	24.8701	8.2352
Minimum	73.8466	-33.2700	-45.5648	-2.5490	-52.5095	0.7474	-3.9662
Std. Dev.	1.3298	18.2848	21.1643	5.5875	33.3325	5.2654	2.8997
Skewness	-1.2112	-0.8149	0.1889	-0.5016	-0.1422	0.7382	-1.6417
Kurtosis	5.7123	3.1898	2.6313	2.8122	2.7121	3.6466	5.2917
Jarque-Bera	22.0466	4.4874	0.4644	1.7362	0.2729	4.3300	26.7216
Probability	0.0000	0.1061	0.7928	0.4197	0.8724	0.1148	0.0000
Sum	3145.60	422.63	-18.36	434.84	950.37	403.80	200.78
Sum Sq. dev.	68.9685	13038.95	17469.25	1217.60	43331.19	1081.26	327.92
Observations	40	40	40	40	40	40	40

The summary statistics for the final transformed series used in the analysis are given in Table 2. While liabilities to assets ratio has been on average around 79% in Sri Lanka during 2000-2010, year-on-year growth of both capital and deposits have been slightly below 11%, on average. Non-performing loans of commercial banks have been declining on average by around 0.5% year-on-year. The ASPI has shown a significant improvement of over 23% year-on-year, which could be due to the remarkable recovery of the stock market following the end of the civil conflict in Sri Lanka in 2009. This is confirmed by the high standard deviation recorded for ASPI. Sri Lanka's year-on-year inflation has been around 10% on average, while GDP growth has been around 5% on average, based on the statistics presented in the Table.

6. Empirical Results: Assessment of Systemic Risk in Sri Lanka

6.1 Vector Auto Regression (VAR) Analysis

To analyse the effect of macroeconomic disturbances on the probability of default on the Sri Lankan banking system, a panel Vector Autoregression (Panel VAR) model is utilised. In addition to the variables discussed above, a constant and dummy variable that represents the period after the end of the internal conflict (PEACE, 2009Q3 onwards=1) is also included. Due to the short time

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series used, the Panel VAR is conducted with only one lag, although the lag order selection criteria indicate that more lags may be necessary to strengthen the results. (See Table 3)

Table 3
Possible Need for More Lags

VAR Lag Order Selection Criteria
Endogenous variables: DEFPROB LIAASSRT D4LTOTCAP D4LNPL D4LTOTDEP D4LASPI D4LCCPI D4LGDP

Exogenous variables: C PEACE

Sample: 2000Q1 2015Q4

Included observations: 185

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4557.70	NA	4.11e+11	49.45	49.72	49.56
1	-3771.88	1486.69	1.68e+08	41.64	43.03	42.21
2	-3453.24	575.2	10756611	38.89	41.40	39.90
3	-3025.72	734.87*	213448.3*	34.96*	38.58*	36.43*

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Irrespective of the shorter than statistically recommended lag length used, the estimated panel VAR satisfies the stability conditions as shown by Figure 8.

Figure 8
Stability of the Panel VAR
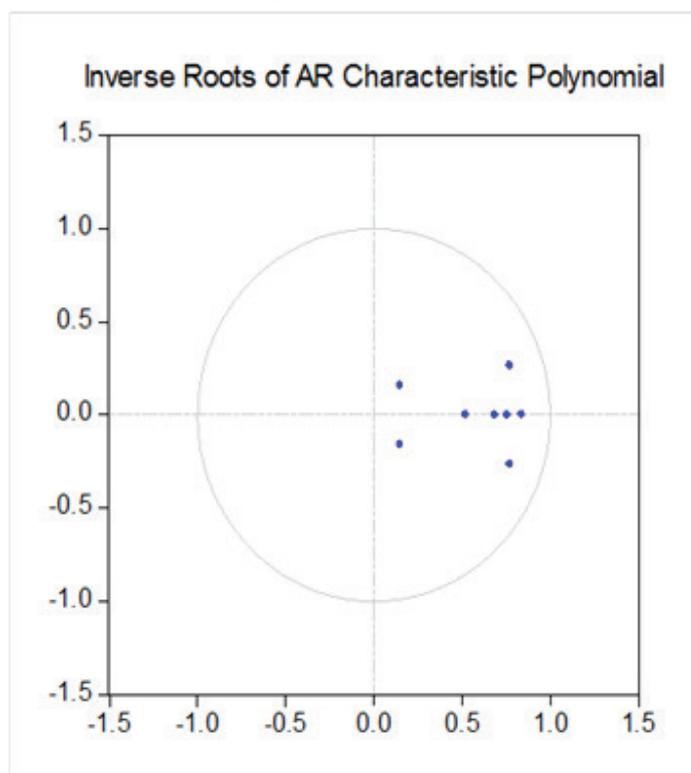
The results of the panel VAR estimates are given in Annexure I.

6.2 Assessment of Systemic Risk

Having estimated a panel VAR model for the economy, a stress test is carried out to assess the systemic risk. To be comparable with the other country studies included in this Volume, the ordering of the endogenous variables are as follows: (1) DEFPROB; (2) LIAASSRT; (3) D4LTOTCAP; (4) D4LNPL; (5) D4LTOTDEP; (6) D4LASPI; (7) D4LCCPI; and (8) D4LGDP.

6.2.1 A Bank-run Shock

First, a bank-run shock is imposed on the estimated system. This shock aims to assess whether the banking system could withstand a sudden withdrawal of bank deposits.

Figure 9
Effect of a Bank-run Shock

Response to User Specified Innovations ± 2 S.E.

Response of DEFPROB to Shock1
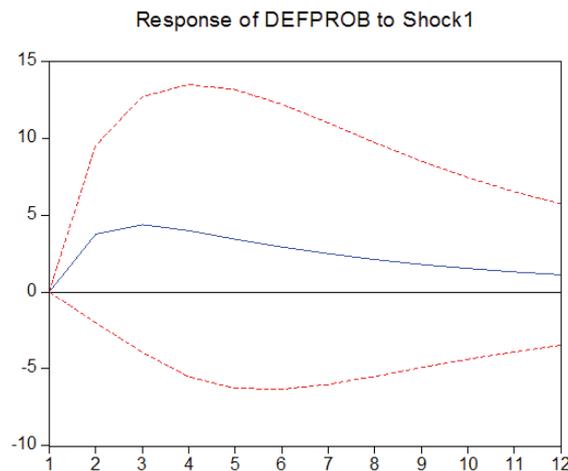
Figure 9 displays the effect of a 10% sudden decline in bank deposits (a run on the banking system) on the probability of default of the banking system. Accordingly, the default probability increases for two quarters following the bank-run shock by around 4-5% each quarter, before it declines thereafter. The forecast error bands are significantly wide, and the reasons for this will be discussed later.

6.2.2 A Financial Stability Shock

The second shock imposed on the estimated system of equations is a financial stability shock. Figure 10 refers to the response of default probability of the banking system to a 10% increase in non-performing loans. Default probability increases by around 0.5% in the ensuing quarter and the effect of the shock disappears by the 6th quarter following the shock. This effect is considerably smaller than the effect of the bank-run shock discussed above. Similar to the effect of the bank-run shock, for the financial stability shock also, the error margins are substantial.

Figure 10
Effect of a Financial Stability Shock

Response to User Specified Innovations ± 2 S.E.

Response of DEFPROB to Shock1
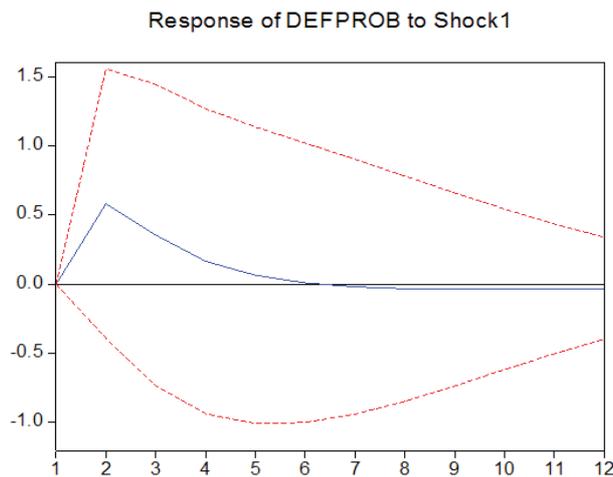
6.2.3 Macroeconomic Shocks

While the bank-run shock and the financial stability shock refer to the disturbances that could arise within the banking system itself due to issues in the financial system, the estimated Panel VAR can also be used to assess the impact of macroeconomic shocks on the financial system. Figures 11 and 12 display the impact of a 10% decline of GDP growth and a 10% increase in inflation on the default probability of banks. While the shock to GDP growth affects the default probability counter-intuitively, and may need further investigation, it is beyond the purview of this analysis. High inflation raises default probability of banks, as shown by Figure 12.

Figure 11
Effect of an Adverse GDP Shock

Response to User Specified Innovations ± 2 S.E.

Response of DEFPROB to Shock1
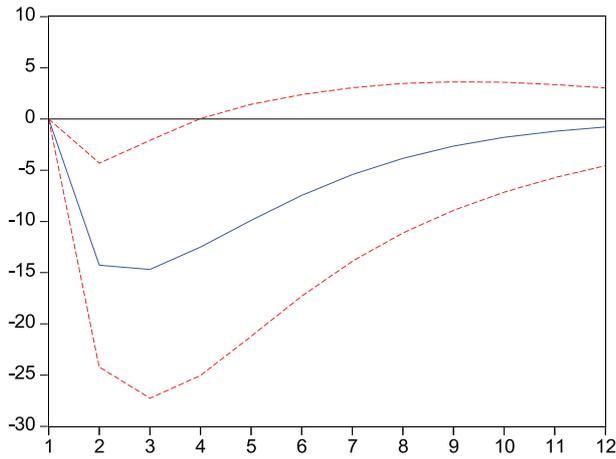
Figure 12
Effect of an Adverse Inflation Shock

Response to User Specified Innovations ± 2 S.E.

Response of DEFPROB to Shock1

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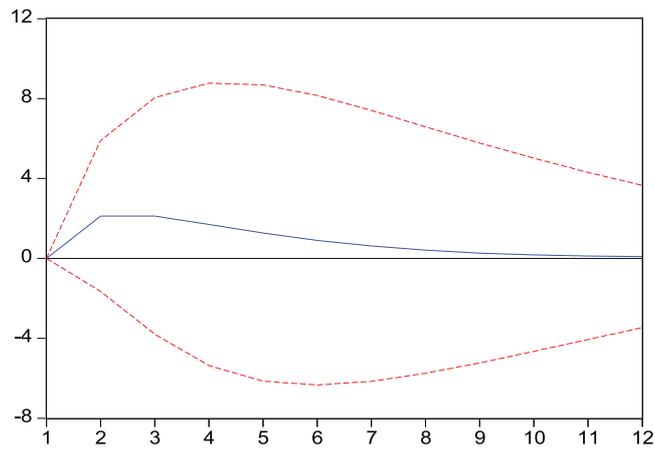
7. Concluding Remarks

The impulse responses presented above with regard to shocks to financial market provide some evidence that the Sri Lankan banking system is sufficiently strong to withstand bank-run shocks and financial stability shocks. However, it must be noted that the default probabilities were obtained using only 5 commercial banks out of the 22 commercial banks that were operative in Sri Lanka at end 2010. The large error bands observed in impulse responses could be due to the fact that there has been a low correlation between the default probabilities of individual banks in the study.

Figure 13
Banking Soundness Index (BSI, 2006Q3=100) and Asset Weighted default Probabilities (AWDP)
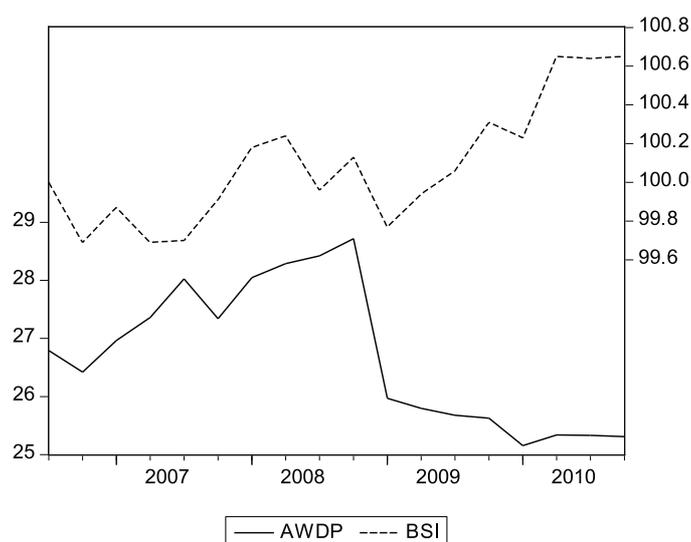
As shown in Figure 13, while the Asset Weighted Default Probabilities (AWDP) of the 5 banks selected appear to be largely in line with the Banking Soundness Index (BSI, Base: 2006Q3=100) computed by the Central Bank of Sri Lanka, for completeness, the study needs to be extended by including state banks, foreign banks, and more recently established banks to capture the banking

sector as a whole. In addition a higher frequency data series (monthly instead of quarterly) could improve the results further. As it is, the framework adopted in this analysis does not warrant including state banks and foreign banks, it provides a useful analytical tool to assess banking sector vulnerabilities along with other methods of analysis used by the Central Bank of Sri Lanka. Other candidate variables that can be included in the analysis are foreign debt of commercial banks, the exchange rate and the interest rate.

The recommendations of the Financial Policy Committee at the Bank of England, as explained by Kohn (2011), are also applicable to Sri Lanka and other countries in the Asian region: "Our recommendations have fallen into one of two broad categories. One category encompasses acquiring information for ourselves and for the public that we believe is necessary ... to monitor and take actions to contain risks to financial stability. The second category has been a series of recommendations to build additional resilience into the banking system without impairing its willingness and ability to perform key intermediary functions, and in particular to supply credit to households and small and medium-sized enterprises."

The methodology provided here can be used to stress test the financial sector against the robust growth of credit currently experienced in Sri Lanka. Specific uses of the methodology can be for the analysis of increased pawning activities against international gold prices, assessing the effect of excess liquidity conditions in the money market, assessing the impact of exchange rate fluctuations on the stability of the banking system in the face of increased financial openness in Sri Lanka, and providing a framework for dynamic provisioning for the banking sector. Continuous efforts to strengthen alternative approaches to stress testing as highlighted by a recent IMF working paper (Schmieder, et al, 2012) are essential in the face of challenges posed by a rapidly evolving financial sector.

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Vector Autoregression Estimates
Sample (adjusted): 2001Q2 2010Q4
Included observations: 195 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	DEFPROB	LIAASSRT	D4LTOTCAP	D4LNPL	D4LTOTDEP	D4LASPI	D4LCCPI	D4LGDP
DEFPROB(-1)	0.7344	-0.0069	0.0896	0.0261	0.0085	0.1326	-0.01720	0.0089
	(0.0483)	(0.0042)	(0.0303)	(0.0413)	(0.0105)	(0.0841)	(0.0140)	(0.0052)
	[15.2051]	[-1.6517]	[2.9609]	[0.6325]	[0.8140]	[1.5767]	[-1.2296]	[1.6873]
LIAASSRT(-1)	1.2545	0.2438	1.4577	1.0079	0.4932	1.5997	-0.0662	0.3787
	(0.7015)	(0.0606)	(0.4397)	(0.6000)	(0.1519)	(1.2212)	(0.2032)	(0.0763)
	[1.7882]	[4.0203]	[3.3153]	[1.6808]	[3.2469]	[1.3099]	[-0.3258]	[4.9636]
D4LTOTCAP(-1)	-0.1507	-0.0138	0.5430	0.2369	-0.0881	-0.1339	-0.0454	0.0378
	(0.1166)	(0.0101)	(0.0731)	(0.0997)	(0.0253)	(0.2030)	(0.0338)	(0.0127)
	[-1.2918]	[-1.3722]	[7.4275]	[2.3761]	[-3.4866]	[-0.6596]	[-1.3455]	[2.9802]
D4LNPL(-1)	0.1202	-0.0024	0.0218	0.5262	0.0019	-0.4552	0.0243	0.0104
	(0.0517)	(0.0045)	(0.0324)	(0.0442)	(0.0112)	(0.0900)	(0.0150)	(0.0056)
	[2.3258]	[-0.5463]	[0.6600]	[11.9113]	[0.1688]	[-5.0603]	[1.6255]	[1.8533]
D4LTOTDEP(-1)	-0.3835	0.1051	0.6097	-0.3825	0.9169	1.4342	-0.0438	0.0074
	(0.3092)	(0.0267)	(0.1938)	(0.2644)	(0.0670)	(0.5383)	(0.0896)	(0.0336)
	[-1.2402]	[3.9316]	[3.1455]	[-1.4468]	[13.6933]	[2.6643]	[-0.4890]	[0.2201]
D4LASPI(-1)	0.1972	-0.0088	0.1501	-0.2623	0.0208	0.2966	0.0388	0.0283
	(0.0402)	(0.0035)	(0.0252)	(0.0344)	(0.0087)	(0.0700)	(0.0116)	(0.0044)
	[4.9047]	[-2.5223]	[5.9582]	[-7.6319]	[2.3851]	[4.2392]	[3.3330]	[6.4673]
D4LCCPI(-1)	0.2952	-0.0248	-0.0954	0.8207	-0.0906	-1.7897	0.8639	0.0044
	(0.2018)	(0.0174)	(0.1265)	(0.1725)	(0.0437)	(0.3512)	(0.0584)	(0.0219)
	[1.4632]	[-1.4196]	[-0.7545]	[4.7584]	[-2.0730]	[-5.0956]	[14.7848]	[0.2023]
D4LGDP(-1)	0.6716	0.0382	0.0384	0.5056	0.1501	-3.7825	0.4674	0.4732
	(0.5310)	(0.0459)	(0.3328)	(0.4539)	(0.1150)	(0.9243)	(0.1538)	(0.0577)
	[1.2649]	[0.8329]	[0.1154]	[1.1140]	[1.3059]	[-4.0922]	[3.0394]	[8.1946]
C	-97.8370	58.8902	-118.3824	-84.2244	-36.8954	-90.6255	4.7406	-28.3407
	(53.9346)	(4.6616)	(33.8050)	(46.1062)	(11.6787)	(93.8903)	(15.6195)	(5.8654)
	[-1.8140]	[12.6332]	[-3.5019]	[-1.8268]	[-3.1592]	[-0.9652]	[0.3035]	[-4.8318]
PEACE	-11.2148	0.7081	-4.8648	3.5684	-0.0357	24.0820	-1.7756	0.3375
	(2.9381)	(0.2539)	(1.8415)	(2.5116)	(0.6362)	(5.1147)	(0.8509)	(0.3195)
	[-3.8170]	[2.7883]	[-2.6417]	[1.4207]	[-0.0560]	[4.7084]	[-2.0868]	[1.0563]

R-squared	0.6675	0.4816	0.8922	0.8666	0.8614	0.7713	0.7544	0.8826
Adj. R-squared	0.6513	0.4564	0.8870	0.8601	0.8546	0.7602	0.7424	0.8769
Sum sq. resids	15753.71	117.68	6188.84	11512.43	738.64	47740.78	1321.24	186.31
S.E. equation	9.2280	0.7976	5.7839	7.8886	1.9982	16.0642	2.6724	1.0035
F-statistic	41.26	19.10	170.13	133.58	127.72	69.33	63.13	154.56
Log likelihood	-704.90	-227.45	-613.80	-674.32	-406.54	-813.00	-463.24	-272.25
Akaike AIC	7.3323	2.4354	6.3979	7.0186	4.2723	8.4410	4.8538	2.8949
Schwarz SC	7.5001	2.6033	6.5658	7.1865	4.4401	8.6088	5.0216	3.0627
Mean dependent	16.1849	78.7630	11.5646	-0.8211	11.1830	24.7653	10.0356	5.1016
S.D. dependent	15.6265	1.0817	17.2029	21.0942	5.2407	32.8038	5.2655	2.8604

Determinant resid covariance (dof adj.)	1.92E+08
Determinant resid covariance	1.26E+08
Log likelihood	-4032.04
Akaike information criterion	42.1748
Schwarz criterion	43.5176

Chapter 9

A MACRO-PRUDENTIAL ASSESSMENT FOR CHINESE TAIPEI

By
Fu-Ying Huang[1]

1. Introduction

Over the past few years, the world economy faced unprecedented challenges. Governments all over the world adopted aggressive expansionary monetary and fiscal policies to deal with the worst economic recession since the 1930s. These decisive actions resulted in positive effects. Apparently, global financial stability has improved in the post-crisis era, but was threatened again this year by the additional pressures resulting from the Eurozone debt crisis. Meanwhile, the commonly called "two-speed recovery" - modest in advanced economies and robust in emerging market economies - has posed different policy challenges for the affected countries.

The 2008-2009 crisis has shown that globalisation works to the benefit of all during good times, but interconnected and cross-border flows can act to compound problems during stressful times. IMF (2011) noted that the emerging market economies are facing new challenges associated with strong domestic demand, rapid credit growth, and large capital inflows. This is putting pressure on some financial markets, contributing to higher leverage, potential asset price bubbles, and inflationary pressures. Policymakers of emerging market economies will have to pay increasing attention to contain the build-up of macro-financial risks, so as to avoid future problems that could inhibit their growth and damage financial stability. This will entail a tighter macroeconomic policy stance, and, when needed, the use of macro-prudential toolkits to ensure financial stability. That is to say, macro-prudential policies also need to account for cross-border dimensions in their crisis management and prevention efforts, especially for the policies of the emerging economies under the globalisation environments.

This paper consists of six sections. Section 2 explains the objectives and instruments of macro-prudential policy. Section 3 introduces the central banks' role in financial stability, including the dual role in monetary and financial stability, and the necessity of a mandate of financial stability. Chinese Taipei's economic and financial soundness indicators and its macro-prudential policy practices as well as policy effectiveness and recommendations will be analysed in Sections 4 and 5, respectively. Section 6 is concluding remarks.

2. Objectives and Instruments of Macro-prudential Policy

In the wake of the latest crisis, the term "macro-prudential" has become a true buzzword (but it may not always be clear what the term exactly stands for. Its meaning remains elusive), and increasingly common in discussions on possible changes to regulatory and supervisory frameworks. Today, it is widely recognised that traditional thinking about ensuring the safety and soundness of individual financial institution as a means of guaranteeing the stability of the whole financial system is no longer perceived as practical. Associated with the realisation of the limited scope of monetary and fiscal policy in securing financial stability, BIS has advocated the use of macro-prudential policy as a means of safeguarding economies against the accumulation of financial imbalances, and has proposed a number of financial reforms at international levels, such as Basel III new regulations and tools to mitigate procyclical and high leverage problems. Nevertheless, the development and implementation of macro-prudential frameworks is still at an early stage. BIS (2011a) noted the identification of systemic risk is a nascent field, and no common paradigms as yet exist. Newly introduced tools will need to be tried out in different circumstances and their performance evaluated against expectations. Importantly, many jurisdictions still lack specific institutional arrangements for the conduct of macro-prudential policy and those that have recently introduced them will need to gather experience.

2.1 Objectives

Macro-prudential policies aim to improve the resilience and soundness of the financial sector as a whole. That is to say, macro-prudential policies are defined as the use of prudential tools with an explicit objective of promoting the financial system as a whole, not necessarily of the individual sectors within it. Thus, macro-prudential policies are defined by its aim (limiting system-wide financial risks), the scope of analysis (the financial system as a whole and its interaction with the real economy), a set of powers and instruments and their governance (prudential tools and those specifically assigned to macro-prudential authorities) (Caruana, 2011a).

There are two objectives for macro-prudential policies:

- One is to mitigate the financial cycle or procyclicality over time; and

- The other is to make the financial system more resilient, given the cycle by moderating systemic risk caused by inter-linkages between the common exposures of all financial institutions at a certain point of time.

2.2 Instruments of Macro-prudential Policy

The latest global financial crisis intensified the official sector's interest in strengthening the current macro-prudential policy arrangements. BIS (2011a) summarised the collective efforts by FSB, IMF and BIS to develop fully-fledged macro-prudential policy frameworks, including tools to mitigate the impact of excess capital flows, in order to deal with systemic risks in financial sector in a comprehensive manner and on an ongoing basis. They define macro-prudential policy as policy that uses primarily prudential tools to limit systemic or system-wide financial risk, thereby limiting the incidence of disruptions in the provision of key financial services that have serious consequences for the real economy. BIS (2010) indicated that many policy functions - including monetary, fiscal and exchange rate policy - can, and often do, promote financial stability in one way or another. But only instruments operated with the explicit primary objective of promoting the stability of the financial system as a whole, and which have the most direct and reliable impact on financial stability, should be thought of as macro-prudential instruments. In this context, macro-prudential instruments also include those used by the micro-prudential policy, monetary policy and fiscal policy related to the area of financial stability. For example, we can easily recognise those instruments from many countries' bail-out measures during the latest financial crisis, such as policy rate cuts, quantitative and credit easing measures.

Macro-prudential policy complements but cannot substitute for the micro-prudential policy and public policy that have an impact on financial stability (such as monetary policy and fiscal policy). In fact, macro-prudential policies aim to address two dimensions of system-wide risks: time dimension and cross-sectional dimension. The key issue in the time dimension is to mitigate the impacts of financial procyclicality, while that in the cross-sectional dimension is to reduce systemic risk concentration, in particular the longstanding "too-big-to-fail" or "too-interconnected-to-fail" problems.

Generally speaking, macro-prudential policy tools are proposed both at international and national levels. For example, in terms of the time dimension,

Basel III countercyclical capital buffer (0-2.5%) and capital conservation (2.5%) applied to common equity Tier 1 on a risk-weighted assets basis, leverage ratio on a non-risk weighted basis, margins and haircuts on securities as collateral, and expected loss provision are those of international levels. For tools at national levels, they comprise loan-to-value (LTV) ratio, debt-to-income ratio, loan-to-income ratio, criteria for loans' eligibility, and specific liquidity requirements. Of these, loan-to-value ratios can improve the resilience of the financial system and also serve as an automatic stabiliser for the system.

In terms of the cross-sectional dimension, policy should focus on systemically important financial institutions (SIFIs). Better resolution regimes for dealing with failing financial institutions could reduce the need for reliance on ex ante buffers such as capital. The Financial Stability Board (FSB) revealed its "policy measures to address systemically important financial institutions" on November 4, 2011. The Basel Committee on Banking Supervision also noted 29 banks currently qualify as global systemically important banks (G-SIBs). The assessment methodology for G-SIBs is built on indicator-based approach and comprises five broad categories: size, interconnectedness, lack of readily available substitutes or financial institution infrastructure, global (cross-jurisdictional) activity, and complexity. The additional loss absorbency requirements include a 1% to 2.5% Common Equity Tier 1 (CET1) depending on a bank's systemic importance with an empty bucket of 3.5% CET1 as a means of discouraging banks from becoming even more systemically important. The higher loss absorbency requirements will be introduced in parallel with capital conservation and countercyclical buffers, i.e., between 1 January 2016 and year end 2018, before becoming fully effective on 1 January 2019.

As for tools of the national levels related to the cross-sectional dimension, the national experiences remain limited. For the time being, some advanced countries, such as the United Kingdom, Germany, and the United States, have enacted the resolution regimes to deal with SIFIs or TBTF (Too Big to Fail) problems at national levels. Alternatively, surcharges on capital requirements that vary with the systemic risk they create could be applied to SIFIs. In addition to increasing capital buffers to nearly double the level of Basel III, the Swiss proposal makes the surcharge sensitive to systemic risk, calculated as a function of the balance sheet size and the market share of the institutions.

3. Central Bank's Role in Financial Stability and Macro-prudential Policy

Traditionally, it allowed the objectives of price stability and financial stability to be pursued through separate tools - monetary policy for the former and micro-prudential policy for the latter. However, the lessons learned from the 2008-2009 financial crisis have shown that it is no longer tenable for the two sets of policies to operate largely independently of each other.

Figure 1
Emergence of Macro-prudential Policy
To Close Gap between Monetary Policy and Micro-prudential Policy
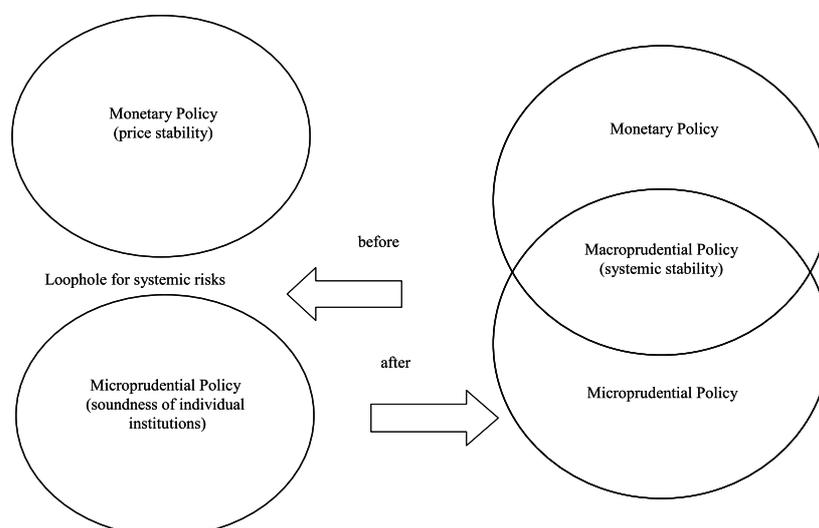
Source: Huang (2011)

The above figure shows there was a significant supervisory loophole between monetary and financial stability before the crisis. Price stability is the main task for monetary policy, while the supervision authority traditionally employs the micro-prudential policy to maintain or strengthen the soundness of individual financial institutions. The loophole of macroeconomic system risks between the monetary

and micro-prudential policy has been overlooked for generations. This is also a critical reason that caused the 2008-2009 global financial crisis. The classic wisdom that monetary policy or micro-prudential policy can exclusively guarantee financial stability does not work well any more; people now have recognised that macro-prudential policy is required to fix the loophole, to manage the systemic risks and to maintain financial stability as a whole. Judging from the right hand side of the figure, the central banks and supervisory authorities undoubtedly share the responsibilities of macro-prudential policy, with the central banks playing a more prominent role.

3.1 Central Banks' Dual Role in Monetary Stability and Financial Stability

In the past, financial crises have always triggered important changes in the governance and practices of central banking. The latest 2008-2009 crisis is not an exception. It has been proved that price stability cannot guarantee financial stability. Thus, central banks have to manage to adjust themselves and confront several new and unprecedented challenges, and devote themselves in an unprecedented degree to coordinating and cooperating with domestic and international regulatory authorities. In many economies, including the emerging economies, the need to develop stronger macro-prudential policies has brought forth a new assignment for central banks. Having both monetary policy and financial stability responsibilities under the same roof has proved rather useful. Eichengreen, et al (2011) argue that there is growing recognition that the conventional approach to central banking needs to be rethought. The relationship between price stability and the broader goals of macroeconomic and financial stability clearly needs to be redefined. They recommend that central banks should go beyond their traditional emphasis on low inflation to adopt an explicit goal of financial stability. Macro-prudential tools should be used alongside monetary policy in pursuit of that objective. The aforementioned recommendation advocates the new central banking practices that central banks should have a dual role in monetary stability and financial stability in the post-crisis era.

3.2 Central Banks Preferred as Regulators for Financial Stability

Generally speaking, there are multiple agencies responsible for the economy's macro-prudential policy. However, the trend for central banks to be handed additional power to regulate financial sectors has been increasing welcomed. Indeed, a central bank is well positioned to take the lead in assessing risks to system-wide stability. Through its role as monetary authority and lender of last

resort, a central bank develops a broad knowledge of the financial system and must constantly maintain a macro-financial perspective. This allows a central bank to assess whether systemic risks are emerging from interactions among different parts of the financial system, and to evaluate the potential impact of financial imbalances on real economic activity. That is to say, combining macro-prudential policy with monetary policy tasks can lead to synergies and a more effective conduct of monetary policy (Huang, 2011).

Several arguments have been put forward to justify why central banks are assuming a prominent role in macro-prudential policy. Sir John Gieve, a former deputy governor for financial stability of the Bank of England, said that internalising regulation within central banks would minimise gaps in the regulatory framework. If there are different institutions, it is difficult to get them to cooperate. Having them within the same roof will help. Paul Mortimer-Lee, the global head of market economics at BNP Paribas, also argued that such a structural change could better help coordinate central banks' efforts to conduct both monetary and financial stability policy. He said if monetary policy had been more coordinated with regulatory policy, then more problems in the banking system might have been addressed at an earlier stage (centralbanking.com, 2010). The Squam Lake Report (2010) suggested it is important to separate systemic regulation from other financial regulation, and central banks should serve as systemic regulators. Caruana (2010) also argued that there are several reasons for central banks to be naturally positioned to play a prominent role in macro-prudential policies. The reasons are as follows:

- They are the only institutions able to provide almost unlimited system-wide liquidity at very short notice.

- 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 devote considerable resources to analysing macroeconomic and financial trends.

Stefan Ingves (BIS, 2011b) also made some good arguments for assigning the financial stability task to the central bank:

- The monetary policy mechanism will not function properly if financial stability is threatened.

- The smooth functioning of the payment system depends on financial stability.

- An important function of a central bank in ensuring financial stability is to be prepared to act as a lender of last resort.

These interdependencies make it natural and necessary for a central bank to seek macro-prudential development.

In short, central banks have already played the part of macro-prudential policymakers. In particular, central banks appear better placed than other authorities to design and implement regulations that address risks that arise from systemically important financial institutions. In any case, the complementarities between monetary policy and financial stability imply that the central bank would always be one prominent member of any multi-agency council or institutional arrangements that deals with an economy's macro-prudential responsibilities. Central banks are the ultimate guarantors of financial system stability.

3.3 Necessity of Explicit Financial Stability Mandates

In order to run macro-prudential policy smoothly, an adequate macro-prudential mandate has to be defined. That is to say, whichever authority is set up to monitor macro-prudential issues, the mandate must be clear at first. In line with the growing consensus that central banks are preferred as financial stability regulators, Carney (2009), Kim (2010), and Shirakawa (2010) all suggested that it is necessary and adequate for central banks to have explicit mandates to promote financial stability. Moreover, according to its published report, BIS working group on financial stability governance also called for explicit and clear mandate for central banks to maintain financial stability (BIS, 2011c). They said that an explicit financial stability mandate will reduce the risk of boundary disputes and provide central banks with sufficient clout to respond to systemic risks. Should the central banks have explicit mandate both on monetary stability and financial stability, they can endeavor themselves to implement the monetary policy and financial stability policy, thereby ensuring the stability of price, finance and real economy. There are a couple of cases that have successfully amended their laws to have a new explicit financial stability mandate for central banks, such as the United Kingdom, Malaysia and Australia. Some countries, such as Korea and Sweden, have submitted similar amendment proposals to their congress or parliament.

Furthermore, should central banks have explicit financial stability mandates, the clear roadmap defining the financial stability responsibilities of central banks would reduce the risk of a mismatch between what the public expect and what the central bank can deliver. Even though it is difficult to define and execute financial stability concepts, it is important to have proper governance arrangements for a central bank to have an explicit mandate. Again, unless there is an explicit mandate in place, central bank will not be able to make difficult decisions. Without ex-ante clarity, decision makers may be caught between the rock of being held to account after the events for actions not taken, and the hard place of being criticised for seemingly unnecessary or costly actions when instability fails to materialise.

As a small and highly open economy, Chinese Taipei recognises that unfettered financial liberalisation and unbridled international capital flows can put financial stability at risk. While many economies are busy debating which of the many government agencies should be responsible for monitoring systemic risks and financial stability, there is no ambiguity in Chinese Taipei. Promoting financial stability and maintaining price stability are two of the four operational objectives set out for the central bank in *Chinese Taipei's Central Bank Act*. Articles 19 to 31 and 33 to 35 of the Act go as far as listing a variety of policy instruments that can be used to achieve those objectives, including targeted prudential regulations.

4. Chinese Taipei's Economic and Financial Soundness Indicators

This section will give a clearer picture of the economic and financial soundness indicators in Chinese Taipei. Notwithstanding the fact that global recovery remains uneven, Chinese Taipei's economic and financial conditions have been quite sound and stable (see Figures 2 to 6 and Figure 7). Chinese Taipei's economic growth rate peaked at 10.88 % in 2010, as compared with a negative growth of -1.93% in the previous year, while inflation (both CPI and core CPI annual rates) remained low and stable.

On the other hand, most of the main financial soundness indicators have performed well. For example, in terms of ROA and ROE, the profitability of domestic banks has increased steadily in recent years. Asset quality remained satisfactory as the non-performing loans ratio decreased to 0.61% at the end of 2010, while at the same period banks' provision coverage ratio culminated to

157.32%. The latter implies that banks' provision for loans and investment portfolios were sufficient to cover potential losses. In recent years, the average capital adequacy ratio for domestic banks as a whole was well above the minimum regulatory requirement of 8%, indicating that capital adequacy for domestic banks remained satisfactory. As for the household sector, its borrowing to GDP ratio averaged at about 82%, but the borrowing service and principal payments to gross disposable income ratio declined significantly from 46.97% in 2005 to 36.12% in 2010. In sum, the steady soundness of financial and household sectors will contribute to the stability of financial system as a whole, as well as the economic stability, even though Chinese Taipei's land price index has been picking up gradually in recent years.

Figure 2
GDP and CPI Growth Rates
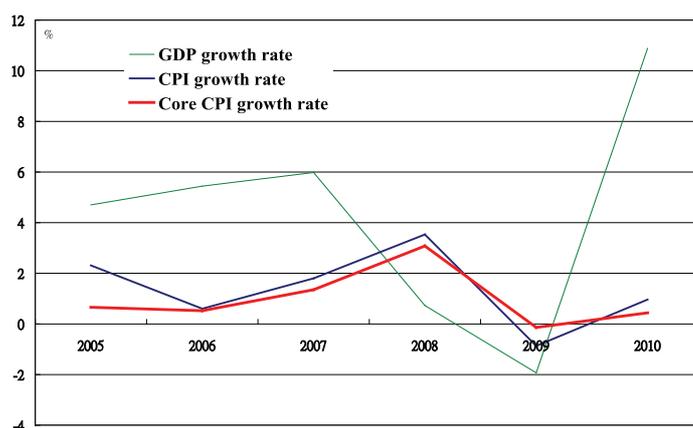
Figure 3
Banks' ROA and ROE
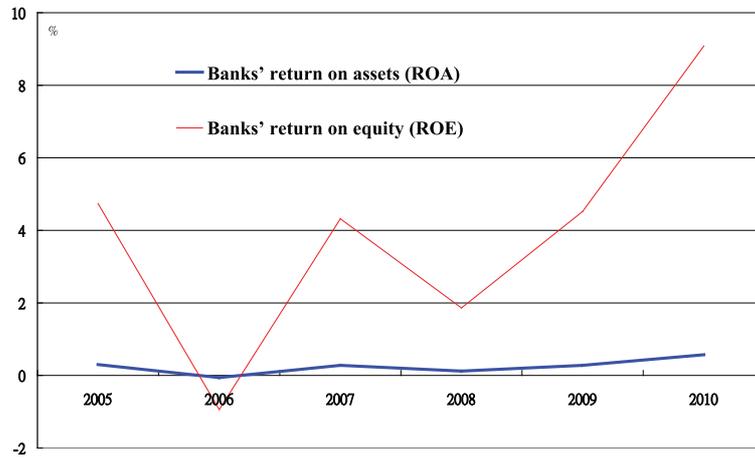
Figure 4
Banks' NPL and Provision Coverage Ratios
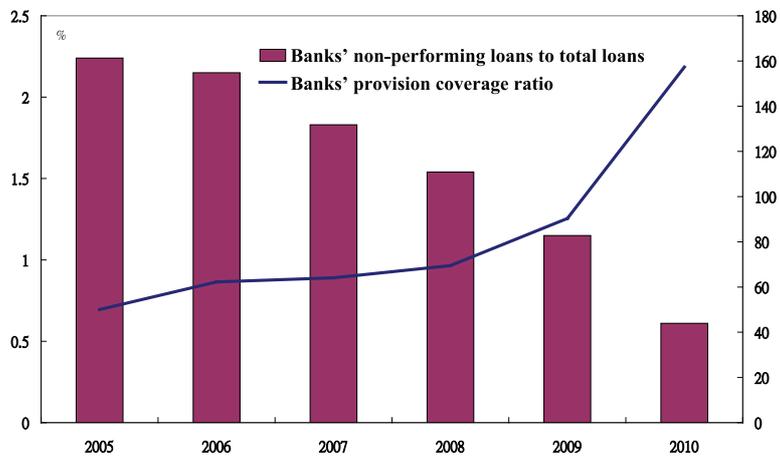
Figure 5
Risk-weighted Capital Ratios

%

— Regulatory capital to risk-weighted assets

— Tier 1 capital to risk-weighted assets
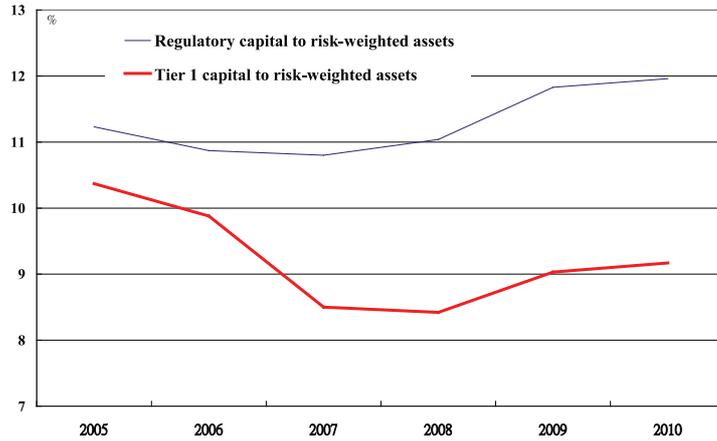
Figure 6
Household Borrowings to GDP and Borrowing Service and Principal Payments to Gross Disposable Income


%

— Household borrowing to GDP

— Borrowing service and principal payments to gross dispossable income
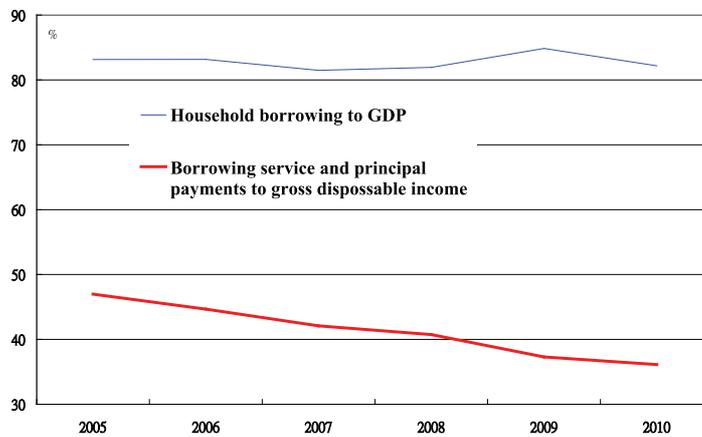
Figure 7
Economic and Financial Soundness Indicators in Chinese Taipei

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
Core CPI growth rate	0.66	0.52	1.35	3.08	-0.14	0.44
Banks' return on assets (ROA)	0.30	-0.06	0.28	0.12	0.28	0.57
Banks' return on equity (ROE)	4.74	-0.94	4.32	1.86	4.52	9.08
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
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
Household borrowing to 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
Land price index	94.68	96.38	98.92	100.51	100.38	105.93

Source: Financial Stability Report, May 2011, Central Bank, Chinese Taipei.

5. Chinese Taipei's Macro-prudential Policy Practices, Policy Effectiveness and Recommendations

This section will firstly describe Chinese Taipei's macro-prudential policy practices, in particular, Chinese Taipei's recent macro-prudential tools on the real estate market, and capital flows management as the large capital inflows put pressures on the economy and financial stability. Policy effectiveness and recommendation will be discussed in the rest of this section.

5.1 Chinese Taipei's Macro-prudential Policy Practices

In response to the global financial crisis and a rapidly changing environment, Chinese Taipei has adopted various prudential policies to ensure financial stability and economic growth. The key policies include the following (Financial Inspection Department, 2011):

5.1.1 Monetary Policy and Capital Flows Management

5.1.1.1 Monetary Policy Instruments

Promoting financial stability is one of the key objectives of the CBC. In 2008 and 2009, the Bank cut the policy rate and adopted various measures to ensure sufficient market liquidity. A total of 237.5 basis points were slashed on seven occasions during the crisis cycle. Lower interest rates helped reduce the funding costs of individuals and enterprises, and encourage private consumption and investment. In contrast, supported by rapid recovery, the CBC has gradually removed its monetary easing policy with 5 moderate rate raises (62.5 basis points) and an increase of long-term NCD issuance to absorb excess liquidity.

Market liquidity measures include: lowering required reserve ratios on banks' deposits; expanding the scope of repurchase agreement operations[2]; helping to strengthen the Small and Medium Enterprises Credit Guarantee Fund to share banks' credit risks; requesting banks to switch the frequency of lending rate reviews from quarterly to monthly to more promptly reflect the Bank's rate cuts. In addition, the Bank also urged banks to continue to extend credit to fulfill their financial intermediary function.

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2. Expanding Repo Facility from September 2008: By expanding the scope of eligible counterparties and collateral, as well as extending the term to a maximum period of 180 days, the CBC provided market access to longer-term liquidity and mitigated systemic liquidity risk to financial markets.

5.1.1.2 Liquidity Monitoring Practice

Besides the liquidity management tools of statutory liquidity ratio[3] and limits on maturity mismatch[4], the CBC has adopted some other measures to monitor the financial institutions' liquidity. Beginning January 2010, the CBC established an ad hoc team, Financial Institution Liquidity Management Team, to manage liquidity variance among financial institutions, control anomaly and research for evaluation methods and standards. In parallel, the other ad hoc team, Financial Monitoring Team, is instituted to communicate with other monitoring authorities, e.g., Financial Supervisory Commission (FSC), to discuss responses of relevant policies.

On the other hand, a joint research team, New Basel Capital Accord Joint Research Task Force, was established in May 2002 to research and develop best practices to manage liquidity in alignment with international standards. The task force studies the rules under the new accord and proposes action plans for promoting compliance by the banking industry. It is hoped that in the process of promotion, banks will face less obstacles in implementing Basel Accord through experience sharing and a supervisor-bank collaboration mechanism is established. In 2009, the aforementioned Joint Research Task Force was reinstated, continually working together to strengthen the requirements based on Basel II.

5.1.1.3 Macro-prudential Policy on Real-estate Markets

The CBC adopted some important macro-prudential policies to enhance the risk management for real estate loans in order to maintain the financial stability. Details will be elaborated in the later section (as shown in Section 5.2).

5.1.1.4 Capital Flow Management

The NT dollar exchange rate is in principle determined by market forces. Nevertheless, excess volatility and disorderly movements in exchange rates due to seasonal or irregular factors (such as massive flows of short-term capital)

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3. The Bank raised the statutory liquidity ratio from 7% to 10ÿ, effective October 1, 2011.

4. In order to monitor the mismatch of major sources of funds and major uses of funds, banks are required to report "Term to Maturity Analysis of NTD Assets/Liabilities" to FSC on a monthly basis. The CBC downloads all the data from FSC for review. According to the regulation, the negative funding gap over total NTD assets within one month is not allowed to exceed the specific values. The specific values are -5% of total NTD assets for commercial banks; -10% of total NTD assets for industrial banks; and -15% of total NTD assets for the export-import bank.

have adverse implications for economic and financial stability. Hence, when the NT dollar exchange rate becomes more volatile than can be explained by economic fundamentals, the CBC will step in to maintain an orderly market.

Significant capital flows may weaken the financial systems of emerging economies, expose them to potential financial instability, and intensify volatility of foreign exchange rate. To avoid such risks, the CBC adopts some measures for capital flows management. The details will be described in the later part of this section (in Section 5.3).

5.1.2 Strengthening Financial Stability Practices

5.1.2.1 Compiling Financial Soundness Indicators Reporting System

Beginning March 2006, the CBC required domestic banks to report financial data to be used for the compilation of the financial soundness indicators. In fact, the scope of the CBC's financial soundness indicators includes banks, enterprises, household, real-estate market and financial markets. The CBC publishes the results of the financial soundness indicators in its Financial Stability Report, in order to examine and show the current status of financial stability.

5.1.2.2 Issuing Financial Stability Report

Beginning June 2008, the CBC issued the Financial Stability Report to acknowledge threats, weakness and potential risk to financial stability and continue monitoring the development of the financial system and macroeconomic factors. The objective is to reveal the current status of Chinese Taipei's financial system so as to contribute to broader discussion, enhance market engagement and raise awareness of potential risks.

5.1.2.3 Financial System Stress Test

One framework to analyse macro-prudential indicators is that of a financial system stress test. Rather than attempting to predict a financial crisis, a stress test involves assessing how exposed the financial system is to certain shocks and in the process highlighting what, if any, are the key vulnerabilities in the financial system.

Since July 2010, the FSC has required domestic banks to undertake micro stress tests with two scenarios[5]. The purpose of the test was to raise awareness of stress tests among domestic banks and improve stress test methods for future reference, allowing domestic banks to conduct independent yearly stress tests[6] in the future. More importantly, the stress test results will be used by the regulator to require domestic banks to adjust their risk management and strengthen capital structure where necessary. Meanwhile, the CBC recently has devoted its attention to the development of a comprehensive and well-organised macro stress test regime.

5.1.3 Strengthening Financial Infrastructures and Financial Environment

In the wake of the recent global financial crisis, the government adopted a blanket deposit insurance regime in October 2008, in order to enhance depositors' confidence and stabilise the financial system. The blanket deposit insurance was initially put in place until the end of 2009. However, the government extended the expiry date to the end of 2010 in an October 2009 announcement, on the concerns about the persistence of global economic and financial instability and extensions of the blanket deposit guarantee schemes adopted by neighbouring economies, such as Singapore and Hong Kong. As for the financial infrastructure, the CBC has deployed the RTGS payment system for clearings and settlements, and reviews and pays close attention to the developments related to payment system on an ongoing basis.

5.1.4 Strengthening Consumer Protection of Financial Services

5.1.4.1 New Financial Consumer Protection Act

The government enforced a new act aimed to protect the rights of financial consumers in the post-crisis era, and to secure the financial stability. The new *Financial Consumer Protection Act*, which passed the third reading in the

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5. One assuming an economic contraction of 1.4%, unemployment of 6.08%, and 10% fall in housing prices, and the other assuming an economic contraction of 2.73%, unemployment of 7.39%, and a 20% fall in housing prices.

6. The FSC announced the results of the second-round stress tests with the two scenarios on an end-2010 basis for domestic banks on September 29, 2011. The stress tests exhibit domestic banks' averaged capital ratios for slight and stressful scenario are 11.10% and 9.65%, respectively, both higher than the 8% minimum requirement.

Legislative Yuan on June 3, 2011, and was effective June 29, 2011, tightens controls on the financial sector and establishes an arbitration mechanism for consumer complaints. The law provides protection for consumers who may not fully understand complicated financial deals by stipulating that banks, investment funds, insurance companies and securities firms must ensure that financial products and services are suited to consumers and inform them of all details and potential risks. The new act will also add an arbitration institution to the FSC by the end of 2011, for recourse to arbitration where legal claims have not been resolved within 60 days. The committee with 9 to 25 financial and legal experts aims to protect individual financial consumers, who often have little resource against the large companies.

5.1.4.2 Implementing Know-Your-Customer Policies

The FSC stresses the importance of banks' know-your-customer policies, through monitoring and enforcing banks to carry out bank account management, rejecting virtual accounts and fraud.

5.1.4.3 Promote and Strengthen Financial Education

Enhancing financial literacy helps consumers to develop financial understanding, knowledge, skills and confidence to make informed decisions, thereby contributing to financial stability and sustainable economic growth and development. However, financial education does not substitute for, but complements prudential and market conduct regulatory frameworks.

5.1.5 Fiscal Policy

5.1.5.1 Expansionary Policy

In response to the global financial crisis, in September 2008, Chinese Taipei's government announced three policy and strategic directions for economic recovery, namely, to stimulate consumption, to encourage investment and development, and to stabilise the financial system and promote exports. The objectives purposed to encourage domestic investment, support fund raising among small- and medium-sized enterprises, improve development of public infrastructure, encourage consumption, increase the employment rate, provide mortgage incentives, stabilise the financial and security markets, expand exports growth, promote tax reforms, etc.

In December 2008, the government launched the consumer vouchers scheme as one of the consumption stimulating measures, in the hopes of encouraging spending and stimulating Chinese Taipei's economy. Under the scheme, each eligible citizen was entitled to receive NT$3,600-worth vouchers for consumer spending. The basic assumption was that citizens would use all the consumer vouchers in a designated period.

5.1.5.2 Contractionary Policy

Beginning June 1, 2011, Chinese Taipei government's *Specifically Selected Goods and Services Tax Act* (the so-called luxury tax) went into effect, aiming at high-priced goods and services, especially the real estate property. Property not occupied by the owner and sold within two years of purchase will be subject to a 10-15% tax. Luxury goods (automobiles, aircraft, yacht, furniture, fur, coral, ivory, tortoise shell, club memberships, etc.) buying will also face a 10% tax. The purpose is to achieve taxation justice, cool the property market, rein in sky-rocketing property prices, and address wealth disparity. The new measures are expected to add an additional sum of NT$15 billion (about US$508 million) tax revenues to the Treasury funds that would be allocated to social welfare programmes.

5.2 Major Macro-prudential Measures on the Real Estate Market

In recent years, the increase in housing prices has been more pronounced in specific areas, adding to the burden of homebuyers. These areas have posted higher price-to-income (PTI) ratios and loan-to-income (LTI) ratios than elsewhere in Chinese Taipei. Moreover, over-concentration in mortgage lending could weaken banks' risk control (Appendix 1). To maintain financial stability, in particular by enhancing risk management for real estate loans, the CBC announced the following macro-prudential policies (The Central Bank, 2010a). The action taken is also aimed at preventing banks' funds from aggravating land and housing market speculation, thus protecting depositors' rights and promoting financial stability.

- Since October 2009, the CBC has taken action to enhance banks' risk management associated with real-estate lending, including (1) moral suasion; (2) enhanced efforts in the collection and analysis of statistical information; (3) target examination on financial institutions; and (4) new regulations formulated to improve control over real-estate lending risks.

- New regulations (Appendix 2) promulgated to govern banks' lending related to housing in "specific areas" and land[7]: (1) For housing in Taipei City and 13 other districts in New Taipei City, the loan-to-value (LTV) ratio for individuals who have taken out other outstanding real estate loans will be capped at 60% with no grace periods[8]. (2) Land collateralised loans are subject to a maximum LTV ratio of 65%, where 10% of the approved loan amount cannot be disbursed until construction commences.

- The CBC's targeted prudential measures are a part of the government's cross-agency efforts under the Plan to Enhance the Soundness of the Housing Market.

5.3 Capital Flow Management in Chinese Taipei

Chinese Taipei has experienced an economic miracle over the past 30 years. The rapid growth of cross-border financial transactions and international capital flows is one of the most important developments. Generally speaking, capital mobility brings many benefits to an economy but can also create instability, and is closely linked to financial crises in a number of economies, especially the small emerging economies after the 2008-2009 global financial crisis. The "big fish in small pond" analogy is quite fitting (The Central Bank, 2011). When a big fish, i.e., large and volatile short-term capital from advanced economies, enters into a small pond, i.e., shallow and less liquid financial markets typical of emerging economies, it causes quite a splash. The size of the recipient economy is too small to absorb the shock. Unfettered short-term capital movements can produce excess volatility and disorderly movements in exchange rate. There is greater consensus on the costs and benefits associated with international capital flows and how much flows can be managed. Therefore, measures can and should be put in place to curb the more risky forms of capital flow and foreign-exchange speculation (The Central Bank, 2010b). Moreover, from a theoretical perspective, an economy cannot simultaneously pursue

7. On June 24, 2010, the CBC announced the Regulations Governing the Extension of Housing Loans in Specific Areas by Financial Institutions (hereafter the Regulations) to contain risk-taking activities related to real estate lending. Under the Regulations, the newly-extended housing loans cannot exceed 70% of the collateral value and have no grace period. The Regulations apply to the area of Taipei city and 10 other districts in New Taipei City.

8. On December 30, 2010, the CBC amended the Regulations to make them more effective. Major amendments included the following: three districts in New Taipei City were added to the scope of Specific Areas in the Regulations; and lowering the maximum LTV (loan-to-value) ratio on second housing loans for home purchases in Specific Areas from 70% to 60%.

monetary independence, exchange-rate stability and capital mobility. Each economy, therefore, must strike a balance that will ultimately promote financial stability and foster long-term economic development. International capital flows present a set of macroeconomic and prudential policy challenges.

Frankly speaking, Chinese Taipei's foreign exchange market is relatively small in scale. In terms of the composition of market players, there are more than 10,000 foreign institutional investors (FINIs) in Chinese Taipei. Among the 6,000 or so are active accounts, of which around 20 FINIs are accounting for over 40% of all foreign exchange transactions. The volume of foreign exchange trading undertaken by FINIs tends to swing wildly, frequently disrupting Chinese Taipei's foreign exchange market. Against this background, we face the challenge that the surge of capital inflows and subsequent outflows driven by external factors may cause excessive fluctuations of the NT dollar exchange rate and impair financial stability. To contain potential risks of destabilising capital flows, and prevent currency speculators from increasing exchange rate volatility, the CBC, collaborating with the FSC, has introduced key measures in 2010 and 2011 (as in Figure 8) to prevent massive international short-term capital movements from destabilising the domestic economy. Chinese Taipei's capital flow management mainly relies on the market mechanism, and capital can flow freely in and out of Chinese Taipei. Restrictions are only imposed on a few short-term financial transactions involving the conversion of the NT dollar.

Figure 8
Capital Flow Management Measures in Chinese Taipei

Date	Measures
August 2010	Starting from August 2, 2010, foreign investors were required to use US dollar margins for securities lending.
November 2010	Starting from November 11, 2010, the amount of investment in government bonds (maturing in one year) by foreign investors would be also subject to the 30% limit of remittances, following the 1995 rule.
December 2010	Starting from December 27, 2010, the combined limit o f non-deliverable forwards and NT dollar foreign exchange options managed by an authori sed foreign exchange bank was lowered to 1/5 from 1/3 of its total position.
January 2011	Starting from January 1, 2011, NT dollar demand deposits placed by foreign investors will be subject to a 90% reserve requirement ratio on amount exceeding the outstanding balance recorded on December 30, 2010. A 25% reserve requirement will apply to the portion below the December 30, 2010 level. In addition, a zero remuneration rat e will be applied to those funds originating from the aforesaid deposits on banks ' B reserve accounts (reserve remuneration) held with the Central Bank.

Capital flow management measures are not, of course, the only tool to deal with capital inflows. Prudential regulations that target specific segments of the economy can also play a useful role in dampening the demand for speculative capital. Hong Kong, Singapore and South Korea have all introduced targeted prudential measures to curb real estate speculation as international capital inflows continue to put upward pressure on asset prices in these economies. At the same time, Chinese Taipei also introduced targeted prudential measures to enhance financial institutions' risk management on real estate loans in June and December, 2010 (see Section 5.2).

In sum, capital flow management measures can be a useful tool to manage capital inflows. Judiciously employed along with other macro-prudential policies, they can reduce financial instability as well as boom-bust cycles, thereby serving as a useful complement to conventional monetary policy instruments as well as macro-prudential policy tools.

5.4 Effectiveness of Macro-prudential Policies on Real-estate Market and Capital Flow Management

It is found that over-concentration in bank lending has continued to be mitigated since mid-2010. For instance, the ratio of housing loans to all outstanding loans has fallen to 26.64 % at end-October 2011 from 27.60% recorded in June 2010. The ratio of newly-extended loans for housing in "Specific Areas" to total new housing loans also went down from 64.4% to 53.8% (see Figure 9 and 10). In sum, the targeted macro-prudential measures introduced since October 2009 have been actively and effectively implemented.

**Figure 9**
Housing Loans to All Outstanding Loans
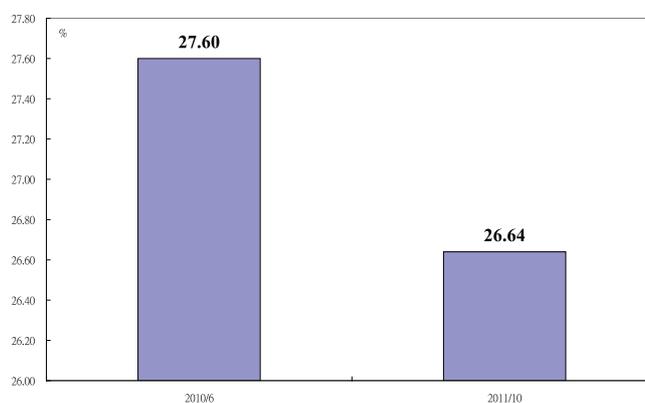
Figure 10
Newly-extended Loans for Housing in Specific Areas to Total New Housing Loans

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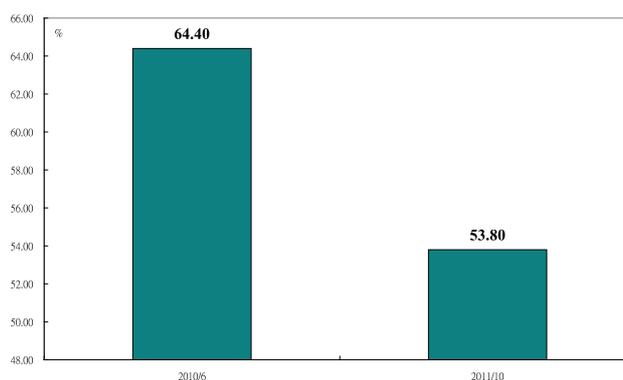
As for the capital flow management, the NT dollar margin deposits of securities borrowing by foreign investors dropped from NT$121 billion to 0 within four months. Foreign investors' holdings of government bonds dropped by NT$42 billion between November 2010 and July 2011. The CBC will continue to enforce the *Regulations Governing the Extension of Land Collateralised Loans and Housing Loans in Specific Areas by Financial Institutions*, and take appropriate actions as necessary in response to new developments. In addition, the CBC will also adopt capital flow measures as necessary when faced with a destabilising surge of capital inflows.

5.5 Policy Recommendations

Chinese Taipei has successfully achieved in moderating the real estate market, as well as managing the capital flows, by way of introducing appropriate and useful measures, in particular the macro-prudential tools. However, as the global and domestic financial and economic situations are still changing dramatically and quickly, it is crucial to review and reform some institutional arrangements and governance. This section provides policy recommendation in order to further promote Chinese Taipei's financial stability.

There are a number of issues needed to be addressed and improved, but it takes time to go from here to there. In the short run, the shortcut to establishing a macro-prudential policy scheme in Chinese Taipei is to reorganise and upgrade the "Financial Supervision Coordination Group" into a "Financial Stability Policy Committee", so that the upgraded body may be able to make financial stability policy decisions and develop a comprehensive framework of macro-prudential policy with macro-prudential indicators and toolkits. Currently, the aforesaid coordination mechanism comprises senior officers of the FSC, the Central Bank and the other related financial authorities. They meet quarterly, and when necessary, to coordinate and cooperate on issues on financial supervision, management and examinations.

6. Concluding Remarks

The 2008-2009 crisis has shown that there is a loophole between monetary policy and micro-prudential policy, and it is not enough to focus on price stability and the safety and soundness of individual institutions. Therefore, new frameworks are needed to enable policies that take account of the systemic effects of institutions and markets. In other words, there has been rising

awareness and consensus to pursue financial stability through macro-prudential policies. Meanwhile, in the wake of the recent financial crisis and amid the two-speed recovery in advanced economies and emerging economies, massive capital has flowed into the emerging market. As a result, capital inflows put strong upward pressure on domestic inflation, as well as on credit and asset price growth. Under such circumstances, the top priority is to apply macro-prudential policies, such as capital flow management measures, to safeguard domestic financial stability. Capital flow management measures are measures of last resort and are better viewed as a safety valve for extraordinary circumstances. Judging from the capital flow management experiences of central banks in the emerging economies, capital flow management measures have been proved effective and useful. Chinese Taipei has also successfully adopted a number of macro-prudential measures to maintain the financial and economic stability in recent years, in particular those related to the real estate market and capital flows.

We need to put more efforts to strengthen system-wide oversight and build up sound macro-prudential policy frameworks, including indicators, toolkits, mandates and governance related to macro-prudential policies in the post-crisis era. It is also important to note that, as Caruana (2011b) argued, financial stability is too large a task for macro-prudential frameworks alone. Macro-prudential policy will be part of the solution, with central banks playing a prominent role. Broadly defined, prudential surveillance and monetary and fiscal policies aimed at financial stability are all macro-prudential policies. In practice, though, they are not interchangeable, but complementary. For example, the CBC adopted a mix of interest rate policy and targeted macro-prudential measures in 2010 in order to tame credit risk to real estate mortgage lending. During 2008 and 2009, at the height of the global financial crisis, monetary easing, consumer vouchers, and blanket deposit insurance coverage, proved to be a successful combination to stimulate consumption while attaining economic and financial stability. Indeed, as the world rapidly changes both economically and financially, using a policy mix to ensure financial stability is more effective than implementing individual tools separately. In particular, while encountering huge short-term capital inflows, which could cause excess liquidity in financial markets and inflate a potential asset price bubble, the CBC may counteract the impacts via capital flow management and macro-prudential measures, in addition to the conventional policy tools.

In sum, financial stability is a shared responsibility that requires both domestic and international cooperation and coordination arrangements. The best governance is to have a single institution that takes responsibility for all cooperation and

coordination. More concretely, a single committee or institution can be charged with deciding on a mix of macro-prudential policy instruments. There is an increasing consensus that central banks with explicit financial stability mandates are obvious candidates for this role. Nevertheless, there are still some challenges in creating an explicit objective of financial stability for central banks. For example, it is said that financial stability objectives are often expressed in directional, rather than absolute terms, and are vaguer than monetary policy objectives. Maintaining financial stability is less easily interpreted than maintaining price stability since price stability can be numerically approximated in terms of generally agreed indices, whereas financial stability can not. Hence, the design of framework and the appropriate toolkit at the disposal of central banks as part of a wider ambit has been a hotly debated topic. How monetary policy may need to adjust to the implementation of new macro-prudential frameworks in the post-crisis era will be an unprecedented and unavoidable challenge for all central banks.

Chinese Taipei is a small open economy and the foreign exchange market is relatively small in scale. Promoting financial stability and maintaining price stability are two of the four operational objectives set out for the central bank in its Central Bank Act. Articles 19 to 31 and 33 to 35 of the *Act* go as far as listing a variety of policy instruments that can be used to achieve those objectives, including targeted prudential regulations. Uniquely, Chinese Taipei's Central Bank and the Financial Supervisory Commission both hold the common legal mandate to maintain financial stability. Furthermore, the two institutions have jointly set up the Financial Supervision Coordination Group to facilitate information exchanges and communication during regular meetings on issues and measures concerning financial stability.

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Background Information Related to the Macro-prudential Policy Measures on Real Estate Markets

Effective Date of Policy Measures	Background Information
June 24, 2010	(1) The total value of real estate loans (for home purchases, home renovations, and building construction) extended by all banks have amounted to 38.3% of their total lending, a value equivalent to 52.0% of GDP. Meanwhile, a large portion of newly extended mortgage loans is concentrated in or around Taipei City and 10 other cities in Taipei County (the now New Taipei City). The concentration of lending may undermine the effectiveness of risk management of banks. (2) In recent years, 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. (3) The CBC has actively urged banks to closely monitor mortgage-lending risks since October 2009. In March 2010, the CBC asked banks to reduce loan-to-value ratios, raise interest rates, and remove grace periods related to loans for investment properties. Furthermore, the CBC has conducted a round of targeted examinations related to real estate lending. (4) Through these targeted examinations, the CBC has found most of the banks have monitored mortgage lending risks effectively, but there are some exceptions. In addition, it was felt that clear and consistent regulations will help address the risks associated with mortgage lending. (5) Financial institutions obtain most of their funding from the public. Therefore, to protect depositors' rights and prevent borrowers from taking on excessive risks, to urge financial institutions to better manage credit risk, and to promote financial stability, the Bank's Board judged that it is necessary to take moral suasion one step further and put in place concrete and explicit regulations. Aimed mainly at high-risk real estate lending, the newly-

Effective Date of Policy Measures	Background Information
	promulgated *Regulations Governing the Extension of Land Collateralised Loans and Housing Loans in Specific Areas by Financial Institutions* are not designed to and will not affect most borrowers. The Bank's Board also called on banks to exercise caution not only with respect to the value of collaterals but also on borrowers' debt repayment ability. In addition, it advised banks to pursue business across a broader spectrum of products and services, to achieve risk diversification and ensure sound operation. (6) The government has been working to facilitate the Plan to Enhance the Soundness of the Housing Market, which was announced in April, 2010. The Regulations announced by the Bank on June 24, 2010 were expected to be conducive to accomplishing one of the Plan's objectives, namely "enhancing risk management for real estate loans." However, sound development of the housing market must rely on further concerted policy efforts under the framework of the Plan.
December 30, 2010	(1) The CBC's policy measures for housing loans in Specific Areas have shown promising results during the third quarter of the year. Nonetheless, burgeoning property transactions since October have led to similar concerns of increased bank lending for home purchases in other regions neighbouring the Specific Areas. (2) Since September 2010, the CBC has used moral suasion and urged banks to rein in risks related to land collateralised loans. However, the management of such risks would be ineffectual if private banks employ a different set of loan standards from those of public banks. The Bank's Board believes that promulgation of new regulations will provide uniform guidance for financial institutions' lending standards. (3) With the aforesaid measures, the CBC aims primarily at discouraging property and land speculation fueled by bank credit, while urging financial institutions to enhance risk management associated with credit extension so as to protect

Effective Date of Policy Measures	Background Information
	depositors' rights and promote financial stability. (4) Looking ahead, the development of a healthy housing market will require concerted policy efforts from various government agencies and institutions under the government's Plan to Enhance the Soundness of the Housing Market.

Key Points of the Regulations Governing the Extension of Land Collateralised Loans and Housing Loans in Specific Areas by Financial Institutions[9] (Hereinafter the Regulations)

I. Scope

1. Financial Institutions referred to in the Regulations include domestic banks, local branches of foreign banks, credit cooperatives, Agricultural Bank of Taiwan, credit departments of farmers' and fishermen's associations, Chunghwa Post Co., and insurance companies.

2. In addition to Taipei City and 10 districts in New Taipei City (Xinbei City), covering Banciao, Sanchong, Jhonghe, Yonghe, Sinjhuang, Xindian, Tucheng, Lujhou, Shulin, Sijhih, the scope of ''Specific Areas'' prescribed in the Regulations is amended to also include 3 other New Taipei City districts, namely, Sanxia, Linkou, and Damsui.

3. Pursuant to these amendments, land collateralised loans shall be governed by the Regulations.

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9. The content of Appendix 2 is provided as a summary of the Regulations and should not be considered or used as the official English translation of the Regulations.

II. Housing Loans in Specific Areas

1. The loan-to-value (LTV) ratio will be capped at 60%, down from 70%, for home purchases in Specific Areas by individuals (natural persons) who have taken out other outstanding real estate loans. Financial institutions shall, before extending new housing loans to individual borrowers against collateral located in Specific Areas, verify the borrowers' credit history related to housing loans with the Joint Credit Information Centre. With regard to housing loans newly extended to borrowers who have other outstanding loans for real estate purchases, financial institutions shall:
(1) Limit new loans to no more than 60% of the appraisal value of the collateral,
(2) Remove grace periods, and
(3) Grant no additional loans against the same collateral for home renovations, as working capital, or for other purposes.

2. Housing loans extended to companies (corporate legal persons) shall be governed by the Regulations and shall conform to relevant rules in the sub-paragraphs (1) to (3) prescribed above.

III. Land Collateralised Loans

When extending collateralised loans against collateral of residential or commercial land plots located in urban planning districts (including, but not limited to, Specific Areas), financial institutions shall:

1. Require borrowers to present concrete plans of construction projects;

2. Apply a maximum LTV ratio of 65% of the acquisition cost or the valuation price, whichever is lower, where 10% of the approved loan amount shall not be disbursed until the construction commences; extend no additional credit for working capital or other purposes.

3. Bills finance companies shall comply with the rules in the above two paragraphs when providing guarantees to bill issuance against collateralised residential or commercial land plots located in urban planning districts.

IV. Effective Date

The Regulations shall enter into force as of December 31, 2010. Loans already approved by financial institutions on or before December 30, 2010, may be disbursed in accordance with the original terms and conditions granted when the loans were approved.