Chapter VIII

Macro-prudential Management

The global financial crisis has urged the international community to recognize that existing financial supervision focusing on soundness of individual financial institutions has severe flaws in maintaining stability of the entire financial system. During the financial regulatory reform in the wake of the crisis, strengthening macro-prudential management became the common choice of main international organizations and economies to address such flaws. Under the G20 framework, a few major international financial organizations and standard-setting bodies are now conducting researches on establishing relevant mechanisms. Currently, the economic and financial environment at home and abroad is increasingly complex and China is also facing challenges for preventing systemic risks. The authorities should strengthen macro-prudential management so as to maintain financial stability both drawing on international regulatory reform experiences and taking account of China's characteristics.

Preventing Systemic Risks Is the Ultimate Goal of Macro-prudential Management

According to *Guidance to Assess the Systemic Importance of Financial Institutions, Markets and Instruments: Initial Considerations* issued by IMF, FSB and BIS in 2009, systemic risk refers to a risk of disruption to financial services that is caused by an impairment of all or parts of the financial system and has the potential to have negative consequences for the real economy.

New changes in the financial sector in recent years created favorable conditions for systemic risks to build-up within and spread across the financial system. These changes mainly include: continuous economic and financial globalization, closer linkage and interdependency between the financial system and real economy, significantly increasing complexity of financial products, systemic impact on the financial system arising from rapid expansion of large financial institutions, tighter interconnectedness of financial market participants, continuous strengthening of collectiveness and synchronization of financial behavior and increasing complexity of the financial system.

The international financial crisis showed that systemic risks arose mainly from two dimensions: cross-section dimension and cross-time dimension. Cross-section risks refer to vulnerability of the financial system induced by interconnectedness between financial institutions, and among financial institutions, markets and infrastructure. For example, for financial institutions with similar risk exposures, synchronized behavior of a number of individual institutions would threaten the entire financial system (herding effect), even though individual financial institutions already meet micro-prudential supervisory standards. Cross-time risks refer to procyclicality in the financial system; that is, in the course of fluctuation in economic cycles, financial risks will be triggered or even exacerbated by interactions within the financial system and between

the financial system and macro-economy. For example, financial institutions sell assets and hoard cash during recessions, and purchase assets and expand credit during booms, each of which would enhance the recession and overheat and intensify cyclical fluctuation, thus affecting the stability of the financial system per se in turn.

Current financial supervision has weakness and gaps in preventing systemic risks. With respect to supervisory goals, current financial supervision mainly focuses on micro-prudential supervision, aimed at preventing risks of individual financial institutions and maintaining soundness and safety of individual institutions and markets. With respect to supervisory scope, current financial supervision falls short not only in monitoring, assessing and managing interconnectedness between macro-economy and financial system, but also in effectively supervising financial institutions, markets and instruments of systemic importance. With respect to supervisory measures, policies and instruments currently employed by supervisors may intensify procyclicality of the financial system and trigger or even exacerbate financial risks. For example, in times of difficulties, individual financial institutions would hoard cash and cease lending simultaneously in order to meet supervisory requirements. Although these decisions and behaviors are prudent and rational for individual financial institutions, they may induce fallacy of composition, and trigger or increase systemic risks.

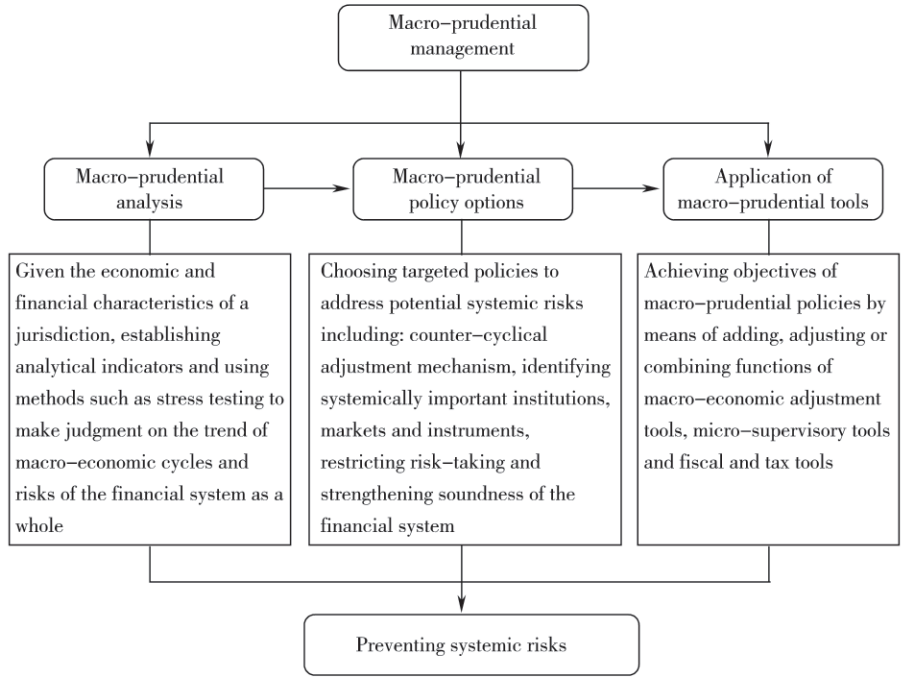
To remedy such flaws, macro-prudential management aims at preventing systemic risks. This macro-prudential approach regards the financial system as a whole, preventing risk spread arising from interconnectedness within the financial system and concerning through-cycle soundness of the financial system, thus regulating risks across the entire financial system effectively and ultimately safeguarding financial stability and supporting steady economic development.

Macro-prudential Management Framework

Macro-prudential management framework is mainly composed of three aspects. First, macro-prudential analysis to identify systemic risks. Second, macro-prudential policy options to tackle potential systemic risks identified. Third, application of macro-prudential tools to achieve objectives of macro-prudential policies.

Macro-prudential analysis. Macro-prudential analysis means making judgment on the trend of macro-economic cycles and risk profile of the financial system by establishing clear and simple statistical indicators, developing early-warning indicators and macro stress-testing of the financial system, and conducting macro-prudential monitoring exercises. Macro-prudential analysis is based on characteristics of the economy and the financial sector. If the financial system is significantly influenced by macro-economy, representative indicators reflecting sound development of macro-economy should be considered

Figure 8.1 Framework of Macro-prudential Management



in macro-prudential analysis; if financial risks of an economy are mainly triggered by certain sector or institution in the financial system and spread across sectors, methods focusing on cross-sector risks should be used in macro-prudential analysis. With respect to the structure of financial systems, in economies where banks are the dominant participants of financial activities, macro-prudential analysis should concern more about credit and balance sheets of banks; while in economies with developed financial markets, securities markets-based price indicators should be the main analytical indicators.

Macro-prudential policy options. Macro-prudential policy options means developing relevant policies to address potential systemic risks identified in macro-prudential analysis. Macro-prudential policy options fall into three main categories. First, counter-cyclical measures should be taken to address macro risks as a result of various procyclical factors. Among which, counter-cyclical adjustment mechanism is used as a through-cycle institutional arrangement, with higher provisioning and capital requirement in good times, to restrict excessive credit expansion, prevent accumulation of asset bubbles and strengthen the capacities of the financial sector to support sustainable development of the economy; with a lower provisioning and capital requirement in bad times, to alleviate credit crunch and asset prices slump, smooth economic fluctuation and facilitate economic recovery. Second, in order to address cross-sector risks, effect of different fi-

nancial institutions to systemic risks should be taken into account to identify systemically important financial institutions, markets and instruments. Systemically important financial institutions should be subject to stringent regulations or systemic risk fees and surcharges. Since systemic risks increasingly arise from similar risk exposures of individual institutions and regulations targeted at cross-sector risks may be temporary and be adjusted as situations change, therefore, it is sometimes difficult to distinguish between macro-prudential policies to address procyclical risks and those to cross-sector risks. Third, measures for restricting risk-taking and enhancing resilience of the financial system should be developed according to the features of structures of financial systems, which include emergency capital requirement, competition policies restricting size and concentration of the financial sector and the business scope of financial institutions, tax policies influencing leverage, incentive mechanism for shareholders and executives of financial institutions, risk-adjusted premium rate for deposit insurance, and financial infrastructure such as LVPS and central clearing facility.

Application of macro-prudential tools. Macro-prudential tools are not specific and independent policy instruments, by adding, tailoring or combining functions of existing macro-economic adjustment tools, micro-supervisory tools and fiscal and tax tools aimed at preventing systemic risks. Therefore, macro-prudential tools are not solely controlled and applied by one specific agency, but by various agencies such as central bank, supervisory agencies, and fiscal and taxation agencies. Macro-prudential tools generally fall into three main categories. First, micro-prudential supervisory tools for macro-prudential purpose, such as capital and liquidity requirements. Second, macro-economic adjustment tools for macro-prudential purpose, which fall into three sub-categories: at aggregate level, such as limits on new loans and M_2 growth rates; at sector level, such as down payment ratio, debt-to-income ratio and interest rate floor for the property sector; at institutional level, such as differentiated reserve requirement, dynamic provisioning and capital buffer. Third, fiscal and taxation tools for macro-prudential purpose. Furthermore, measures in response to crises such as central bank's function of lender of last resort and resolution authority for failed financial institutions can also serve macro-prudential management purpose.

The central bank should be adequately equipped and mandated to play a key role in macro-prudential management. Macro-prudential management is in essence an integral part of macro-economic management, with similar objectives to those of the central bank to maintain macro-economic and financial stability. The central bank takes corresponding responsibilities and has advantage in macro-prudential analysis and use of monetary policy instruments, so it is internationally accepted and commonly emphasized that the central bank should be adequately equipped and mandated to play a key role in macro-prudential management. Meanwhile, macro-prudential management is closely linked with macro-economic management and micro-su-

pervision. On one hand, achieving objectives of macro-prudential management may have an impact on those of monetary policy and financial supervision. On the other hand, the effects of implementing macro-prudential tools depend on how to implement monetary policy instruments, micro-supervisory tools and fiscal and tax tools. Therefore, enhanced communication and coordination and adequate information sharing between relevant agencies are indispensable for effective macro-prudential management. In order to ensure transparency and consistency of macro-prudential management, relevant agencies should intensify joint researches, make consistent decisions and apply macro-prudential tools respectively according to the decision. Moreover, to supervise cross-border financial activities with macro-prudential approach, efforts should be made to enhance coordination between jurisdictions so as to tackle problems such as cross-border supervisory arbitrage.

Enhancing Macro-prudential Management Is the Core of Post-crisis International Financial Regulatory Reform

Before the outbreak of the global financial crisis, financial supervision mainly focused on preventing individual financial institutions' risks. When individual financial institutions appeared to be healthy and sound, supervisors were not concerned too much about the increasingly substantial impact on the financial system of tighter interconnectedness within the financial system and from macro-economy. There were severe gaps in macro-prudential management. First, financial institutions, instruments and markets of systemic importance have not been effectively or adequately supervised. Second, financial institutions and products of various types and in different regions were subject to different supervisory regulations and rules, leading to severe supervisory arbitrage for similar financial activities. Third, financial supervisory policies and tools such as capital requirement in Basel II, loan provisioning, external credit rating and fair value accounting standards are inherently procyclical and, to some extent, intensify fluctuation of economic cycles. Fourth, necessary institutional framework for systemic risks prevention has not been established and information about financial risks cannot be shared on a timely basis, resulting in difficulties in identification, early-warning and resolution of systemic risks.

As a remedy for such flaws, strengthening macro-prudential management became the consensus of financial regulatory reform in the international community in the wake of the crisis. The idea of macro-prudential management was invented by BIS in as early as late 1970s, but had not raised too many concerns. Since the outbreak of the international financial crisis, learning from the causes and lessons of the crisis, the international community has proposed that enhancing macro-prudential management be the core of international financial regulatory reform. The first 4 of 25 rec-

ommendations made by G20 London summit report *Enhancing Sound Regulation and Strengthening Transparency* all urged authorities to enhance macro-prudential management. Following G20 requirements, FSB, BIS, BCBS, CGFS and other standard-setting bodies are now conducting researches on enhancing policies and tools for macro-prudential management. Jurisdictions such as US, UK and EU focused on enhancing macro-prudential management in supervisory reform and achieved this purpose by reforming supervisory institutional framework and relevant rules.

Clarify Objectives and Responsibilities of Relevant Agencies in Preventing Systemic Risks

In June 2009, Obama Government submitted to the Congress *Financial Regulatory Reform: A New Foundation*, focusing on enhancing the role of Federal Reserve in supervising systemically important financial institutions, markets and instruments, collecting information about risks and providing emergency assistance when needed. In February 2009, UK enacted *Banking Act* 2009, clarifying legal responsibility and core status of Bank of England in financial stability and enhancing its policy instruments and power in maintaining financial stability. In July, HM Treasury released *Reforming Financial Markets*, reiterating the objective of Bank of England in maintaining financial stability and the applicable market-based tools to achieve the objective. In May 2009, the European Commission published *European Financial Supervision*, proposing to establish a European Systemic Risk Board and emphasizing the leading role of the central banks in macro-prudential management. In August 2008, France enacted *Modernization of the Economy Law*, empowering Bank of France to tackle systemic risks and crises.

Enhance Macro-prudential Analysis

All countries undertaking financial regulatory reforms emphasized enhancing macro-prudential analysis in their reform plans, focusing on monitoring indicators such as underwriting and pricing of loans, leverage ratios and asset prices, and assessing potential threat to financial stability arising from macro-economy and development of the financial system. US *Financial Regulatory Reform: A New Foundation* suggested that a Financial Service Oversight Council should be established to facilitate information sharing and supervisory cooperation and identify systemic risks. The Council should be empowered to alert supervisory authorities against risks and require them to respond to the risks. The European Systemic Risk Board will be responsible for collecting and processing information about macro-economy, financial stability and financial supervision, monitoring and evaluating potential threat of systemic financial risks, publishing early-warning when risks are becoming severe, making recommendations for actions to address such risks when necessary, and monitoring implementation of early-warning and recommendations by relevant agencies. UK *The Turner Review* put forward establishing macro-prudential analysis framework, under which Bank of England and Financial Services Authority should jointly conduct in-depth macro-prudential analysis and develop relevant

policy instruments.

Establish Counter-cyclical Adjustment Mechanism

According to the G20 requirements, FSB, BCBS and other standard-setting bodies are conducting researches on establishing counter-cyclical adjustment mechanism, which mainly include establishing counter-cyclical capital buffer mechanism and forward-looking provisioning system and increasing the financial system's capacities to absorb losses. Moreover, the capital quality and adequacy level of financial institutions should be improved and capital requirements for complex financial products should be enhanced; stable and long-term source of liquidity for financial institutions should be established and international supervisory coordination on liquidity risk and cross-border supervision on liquidity funding should be strengthened; financial institutions should develop effective compensation governance, dynamically adjusting compensation based on different risk-taking practices and aligning executive compensation with firms' long-term soundness and overall performance; disclosure requirements for off-balance sheet activities should be promoted, complexity of financial instruments accounting should be decreased and procyclicality of fair value accounting standards should be reduced.

Expand Supervisory Coverage and Enhance Supervision of Systemically Important Financial Institutions, Markets and Instruments

In October 2009, FSB released guidelines and a work plan for assessing systemic importance of financial institutions, markets and instruments, in which three criteria of assessment are recommended: size, substitutability and interconnectedness. It also proposed to reduce moral hazard of systemically important financial institutions by strengthening supervision of capital, liquidity, leverage, risk management, organizational structures, business models, and crisis resolutions. On expanding supervisory scope, US *Financial Regulatory Reform: A New Foundation* proposed supervisory and information disclosure requirements for investment advisors to private capital pools such as hedge funds, private equities and venture capital, emphasized enhancing supervision on securitization and credit rating agencies, and would establish central counterparties (CCPs) for OTC derivatives. HM Treasury *Reforming Financial Markets* emphasized supervision on off-balance sheet vehicles and appropriate prudential supervision on systemically important hedge funds or alternative investment intermediaries to mitigate risks arising from supervisory arbitrage. European Commission *European Financial Supervision* emphasized that all institutions in the financial system with potential systemic risks should be subject to financial supervision and that shadow banking system should particularly be supervised. The above-mentioned reform plans included the following specific measures for enhancing supervision: First, implementing stricter prudential standards. Large banks should be subject to higher requirements for capital, liquidity and risk management and conduct stress testing. Second, on-site examinations and risk monitoring on large banks should be enhanced and fire-

wall measures should be taken. Third, complexity of organizational structures and activities of large banks should be reduced, and it should be clarified that how such banks can obtain emergency funds by selling subsidiaries or assets in times of difficulties to ensure orderly resolution for failed banks. Fourth, sound compensation mechanism ensuring alignment of compensation scheme with risk exposures should be established to prevent banks from excessive risk-taking for short-term returns. Fifth, communication and cooperation between supervisory authorities and between supervisory authorities and macro-economic management agencies should be enhanced and cross-border supervisory colleges should be established.

Box 18 Impact of Systemically Important Financial Institutions on Financial Stability

In the financial crisis, many large financial institutions such as Lehman Brothers, AIG and Northern Rock became distressed or even went bankrupt, heavily hitting the global financial system, intensifying deterioration and spread of the crisis and highlighting impact of systemically important financial institutions on financial stability.

Lehman Brothers was the fourth largest investment bank in US and one of the biggest mortgage loan providers, ranking 5 of fixed-income services providers in US, providing comprehensive and diversified services for customers worldwide. At the end of Q2 2008, Lehman Brothers' assets amounted to around USD 600 billion, while total assets of dealers in US amounted to USD 3 trillion at the same period. Lehman Brothers was creditor/debtor to many institutions with a lot of money market funds as its creditors. At the end of Q2 2008, its unrealized gain amounted to USD 46 billion while unrealized loss amounted to USD 26 billion. Meanwhile, Lehman Brothers was the most important dealer for many institutional customers (e. g. , hedge funds) and provided settlement service for them. The failure of Lehman Brothers firstly transferred credit risk to its counterparties, causing huge losses for many money market funds. Secondly, being the most important broker for many institutions, Lehman Brothers' failure disrupted normal operations in these institutions. Thirdly, investors speculated that Lehman Brothers would liquidate its assets to pay its debt, leading to widely asset revalued. Other financial institutions ran to dump their assets to reduce losses, which triggered "herding effect" among investors, causing a vicious circle of "stop loss—sell—further stop loss—further sell", intensified fluctuation of financial markets and triggered systemic risks.

AIG was the largest insurance company in US, with counterparties around the world and businesses across different sectors inclu-

ding banking, securities, insurance and annuity. AIG invested heavily in the US sub-prime mortgage markets and at the same time, buttressed by its credit rating of AAA, and, as one of the most important CDS providers worldwide, it provided CDS for enormous mortgages backed CLO and CDO. Because of its huge exposures to the property market, AIG suffered substantial loss in the sub-prime mortgage crisis. Systemic importance of AIG in the financial system can be reflected as follows: if AIG is let go bankrupt without any government intervention, interests of millions of the insured will be harmed and annuity plans with a total amount up to USD 40 billion cannot be effectively protected; local governments with claims of USD 10 billion and banks, investment banks and mutual funds with claims of USD 70 billion will lose heavily; normal trading of the global CDS market will be disrupted.

Moreover, some institutions of very low systemic importance, if any, will also have systemic threat to the entire financial system in specific circumstances. For example, as of the end of 2006, assets of Northern Rock in UK accounted for only 2% of the total assets in UK's banking system, claims of Northern Rock accounted for 2.5% of those of major banks in UK, and market capitalization of Northern Rock accounted for 0.3% of British total stock market capitalization, however, as the fifth biggest bank in mortgage providers in UK with a business model of funding from financial markets by issuing mortgage-backed securities accounting for 17% of the total MBS in UK, Northern Rock could substantially influence the securities market. Therefore, when Northern Rock went into financial distress, banks with the same capital structure and business model for funding suffered, further leading to the turmoil of the entire banking system.

The above mentioned cases typically illustrated that with large size, numerous counterparties, complex organizational structures, intensified interconnectedness with other institutions and investors, and lack of substitutability in providing financial services, some financial institutions are systemically important in the financial system. Once facing difficulties, assisting these institutions will not only be costly for the government but also intensify market panic by shattering confidence of counterparties and the market, causing instability of the entire financial system and ultimately having an adverse impact on the real economy. Therefore, effective measures should be taken to enhance supervision of these systemically important financial institutions.

Enhance Coordination and Cooperation between Financial Management Agencies

US *Financial Regulatory Reform: A New Foundation* enhanced Federal Reserve's responsibilities for systemic risk monitoring and proposed for establishing Financial Services Oversight Council to promote information sha-

ring and supervisory cooperation and resolve disputes between supervisors. On December 11, 2009, the House of Representatives passed *Wall Street Reform and Consumer Protection Act of* 2009, which would create an interagency Financial Stability Oversight Council (FSOC) as systemic risk supervisor responsible for identifying financial institutions and activities having threat to financial stability. On March 15, 2010, Dodd, chairman of Senate Banking Committee, released *Restoring American Financial Stability Act of* 2010, which would create an interagency Financial Stability Oversight Council (FSOC) responsible for identifying, monitoring and tackling systemic risks caused by large complex financial institutions and financial products and activities causing risks to spread among different institutions. HM Treasury *Reforming Financial Markets* proposed to establish a Financial Stability Committee composed of representatives from HM Treasury, Bank of England and FSA respectively, in which the Chancellor of the Exchequer would act as chairman. Financial Stability Committee would be responsible for assessing systemic risks and coordinating intervention by the three member agencies when major risks emerge. European Commission *European Financial Supervision* suggested that European Systemic Risk Board (ESRB) be responsible for macro-prudential management and European System of Financial Supervisors (ESFS) enhance communication, share macro-prudential analysis results and take joint actions according to early-warning or recommendations.

Enhance Macro-prudential Management and Prevent Systemic Risks in China

Experiences on Macro-prudential Management

In recent years, according to the blueprint by the CPC Central Committee and the State Council, PBC, together with other agencies, continuously strengthened and improved macro-economic management, promoted financial reform and took various measures to maintain financial stability, which contributed to effectively withstanding the adverse impact of the financial crisis to China's financial system and promoting steady and rapid development of the national economy.

Enhance monitoring and assessment of systemic risks. A preliminary indicators system for monitoring financial stability in China has been established, assessment methodology and operational framework for monitoring financial risks have been developed, *China Financial Stability Report* has been published annually since 2005, comprehensively assessing the stability of the financial system in China. Methodology for monitoring and assessing risks in the banking, securities and insurance sectors has been explored to prevent cross-market and cross-sector financial risks.

Take various measures to prevent systemic risks. Macro-economic management has been further enhanced and improved, and diversified monetary policy instruments have

been used collectively to promote steady and rapid development of the national economy. Reform of large financial institutions such as ICBC, ABC, BOC, CCB, BOCOM and CDB has been promoted, corporate governance of financial institutions further improved, incentive and competition mechanism established and healthy institutions cultivated. Reform and development of financial markets have been accelerated, market structure improved, market of products diversified, and direct funding promoted. Financial infrastructure has been improved, modernization of the payment and settlement system further advanced, sound functioning of such system safeguarded and establishment of credit information system steadily promoted.

Properly tackle insolvent financial institutions. PBC, together with supervisory agencies and local governments, promoted the exit of 16 insolvent financial institutions, took the lead in tackling risks of Delong and restructuring of risky securities companies, cooperated with supervisory agencies in resolution of RCCs and securities companies, improved supervision on individual creditors acquisition, advanced establishment of the third-party custodian of customers' transaction settlement funds and improved exit mechanism of financial institutions.

Improve and strengthen financial supervision and improve financial supervisory coordination mechanism. Under the leadership of the State Council, PBC, CBRC, CSRC, CIRC and SAFE jointly conducted researches on critical issues in the financial sector, facilitate interagency coordination to formulate measures in response to crises on a regular basis. Agencies for macro-economic management including NDRC, MOF and PBC held meetings periodically to make analysis and judgment on macro-economic and financial situation. PBC took the lead in formulating *Interim Rules on Information Sharing between PBC, CBRC, CSRC and CIRC*, while financial supervisory agencies including CBRC, CSRC and CIRC signed *Memorandum of Understanding on Division of Responsibilities and Cooperation in Financial Supervision*. Since the onset of the global financial crisis, PBC and financial supervisory agencies have enhanced researches on macro-prudential management and explored to promote sound operation of financial institutions with instruments such as counter-cyclical capital buffer, dynamic provisioning and capital surcharge requirements.

Establish long-term effective mechanism for preventing systemic risks. Contingency mechanism for financial institutions has been established and improved, and contingency responding schemes on tackling systemic risks formulated. The central bank's function of lender of last resort has been strengthened and the central bank has been equipped to maintain well functioning of the financial system. Securities investors protection and insurance protection systems have been established, the financial safety net improved and the establishment of deposit insurance system is under study.

Improve Macro-prudential Management Regime in China

Currently, the Chinese financial system still faces the challenges of preventing systemic risks. On one hand, the Chinese characteristics determine that the linkages between financial system soundness and macro-economic policies are more straightforward and closer and there is significant uncertainty in macro-economic adjustment. The global economy sees signs of recovery but it is unstable. Meanwhile, the exit process from extraordinary policies will be complicated with dynamic games among countries. Domestic credit boom will continue to grow with a strong momentum, which, combined with the recovery of external environment, will result in excess liquidity, increasing macro-risks including inflation, asset price bubbles and cyclical increase of NPLs significantly. In China, bank loans play an important contributing role to financial stability, but regulatory instruments for such loans are relatively scarce for the moment. To address these potential risks and gaps, the government should enhance macro-prudential management and increase regulatory flexibility: keep suitable intensity as well as appropriate timing and ways for policy adjustment to prevent and control macro-risks. On the other hand, in recent years, with the rapid development of cross-sector and cross-market institutions and financial products, financial institutions in banking, securities and insurance sectors respectively have been increasingly involved in the other sectors, eventually culminating financial holding companies with complex organizational structures and diversified businesses. Meanwhile, quasi-financial institutions such as guaranty companies, pawning houses and private equity funds have been involving in financial activities in-depth. All these new developments have a potential impact on stability of the financial system. However, the current supervisory framework is inadequate to supervise systemically important financial institutions, instruments and markets mentioned above. Therefore, it needs to be further improved by enhancing macro-prudential management to fill supervisory gaps and eliminate loopholes.

Box 19 Macro-prudential Analysis Method: Financial Network Model Based on Data from Payment and Settlement System

As the first step to enhance macro-prudential management, macro-prudential analysis focuses on analyzing, monitoring and assessing systemic risks. Researches show that the financial network of connectivity formed by links between financial institutions plays a critical role in understanding and grasping systemic financial risks.

Global Financial Stability Report released by IMF in April 2009 laid out four quantitative models assessing the correlations of financial

institutions: the network approach, the co-risk model, the distress dependence matrix and the default intensity model. Based on the network approach and using inter-bank payment and settlement data we can build a model of financial network structure in China to dynamically reflect the process of liquidity risk transmission between financial institutions (mainly banks).

1. Financial network model

Using data from inter-bank payment system, we build the financial network model based on the following assumptions:

The network nodes refer to different banking institutions and the edges connecting the nodes are flowing of funds between these institutions. Assume the number of institutions in the entire system is n, and the fund transactions among them form a $n \times n$ matrix, M, namely liquidity matrix. In the time period t, the matrix M of inter-bank payment and settlement is represented as follows:

$$M = \begin{bmatrix} M_{1,1} & \cdots & M_{1,j} & \cdots & M_{1,n} \\ \vdots & & & \vdots & \\ M_{i,1} & \cdots & M_{i,j} & \cdots & M_{i,n} \\ \vdots & & & \vdots & \\ M_{n,1} & \cdots & M_{n,j} & \cdots & M_{n,n} \end{bmatrix}$$

Where element M_{ij} represents the amount of funds flowing from institution i to j in the time period t. We then define the total outflow vector $\bar{p} = (p_1, \ldots, p_n)$ as $p_i = \sum_{j=1}^{n} M_{ij}$. We can characterize the banking network with three variables, $\prod$, p and c. Let $\prod$ be an $n \times n$ matrix with a definition, $\prod_{ij} = \frac{M_{ij}}{p_i}$ that represents the proportion matrix of the fund transactions among banking institutions. The variable $\bar{c} = (c_1, \ldots, c_n)$ is the vector of fund stock, where c_i represents the position of excess reserve of institution i in the payment and settlement system. If we introduce the time factor, a dynamic banking network is expressed as $(\prod^t, \bar{p}^t, \bar{c}^t)_{t=-\infty}^{+\infty}$. From any time point t, we have a static cross section.

If no funds flows into the network from outside and participants have homogenous behavior, we get the following liquidity risk transmission mechanism:

$$c_t^{t+1} = c_i^t + \sum_{j=1}^{n} \prod_{ij}^{t} p_j^t - p_i^t$$

Using data from settlement system, we can conduct shock testing on network stability at any time to assess multi-dimensional stability of the banking network and identify and reflect transmission process of systemically important institutions and their liquidity risk.

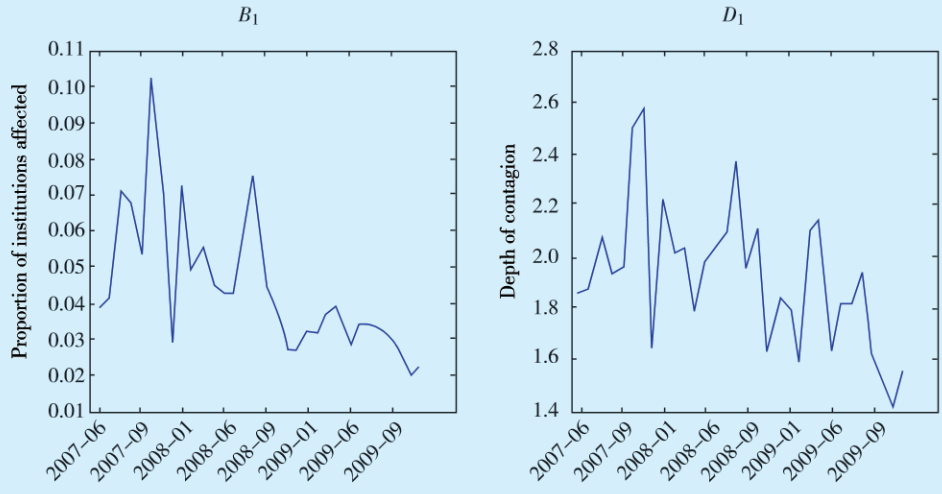
2. Trend analysis of financial network stability in China

Based on empirical analysis of data from payment system throughout 32 months from May 2007 to December 2009, we get the value of two indicators, breadth (B_1) and depth (D_1)[1], of financial network stability

1 B_1 and D_1 are network stability indicators, which refer to the number of institutions affected and round of impacts. The higher B_1 and D_1, the weaker the network stability and the higher systemic risks and vice versa.

in China. During this period, changes of B_1 and D_1 were very close to each other and both obviously downward, which meant financial system stability in China had been continuously strengthened during the period.

Figure 8.2 Trends of Financial Network Stability Indicators in China



It is necessary to point out that changes of B_1 and D_1 saw an upward movement during the period from May 2008 to August 2008, which meant temporary weakening of financial network stability in China during the period and matched the increasing impact of the global financial crisis on the domestic financial system. From then on, thanks to implementation of macro-economic management policies, real economy stabilized and recovered gradually. Meanwhile, commercial banks adjusted operation strategy timely. Subsequently, B_1 and D_1 began to decrease, meaning that financial network stability was gradually strengthened and systemic risks level in the financial system had been obviously decreased.

3. Structural characteristics of the financial network in China

The inter-bank network is a highly interconnected one and different nodes play different roles in the network depending on the degree of interconnectedness. Even if sharing similar average stability, different network structures may be imposed different management and adjustment measures by macro-prudential supervisory authorities. Moreover, since network structure will change to some degree over time, it is impossible to make macro-prudential analysis from the perspective of financial network without understanding of the network structure.

We select June 2009 as the time point for preliminary analysis of structural characteristics of the banking network in China. Considering difficulties in getting detailed data, we analyze two networks with different detailed degree of data. The first network, covering 84 nodes, includes large commercial banks, policy banks, joint stock commercial banks, city commercial banks, rural commercial banks, rural cooperative banks, RCCs, UCCs, PSBC and foreign banks. In particular, city commercial banks, rural commercial banks, UCCs and RCCs are taken as four single nodes. In the second network, RCCs are individually itemized and connected with the first network, so the number of total nodes is 125.

1) The first network

The liquidity risk transmission demonstrates that if liquidity shocks come from large commercial banks would affect an average of 25 banks, around 30% of all institutions, in different degree. Except for rural cooperative banks, other nodes affected are all foreign banks. If the big four commercial banks are taken as an independent set of troubled institutions, the shocks would affect 60% of all institutions and 76% of total fund repeatedly for 6 rounds, including 2 policy banks, 9 shareholding banks, RCCs and many foreign banks. This highlights the core status of large commercial banks in the network. If any one of these banks gets into trouble, the network would be seriously shocked.

Liquidity shocks coming from policy banks would affect 5 institutions, all foreign banks, and 4% of total fund, repeatedly for 3 rounds at most. However, liquidity shocks coming from some large commercial banks or joint stock banks would affect certain policy banks to some extent. This shows that while policy banks as a group have weak shocks on the network, they are not isolated.

Liquidity shocks coming from joint stock banks would affect 50% of all institutions and 34% of total fund, repeatedly for 5 rounds, and the institutions affected are mainly foreign banks. This shows that joint stock banks are highly interconnected but their shocks are far weaker than those of the big four commercial banks.

PSBC reported considerable total assets up to RMB 2.4 trillion, making it a player cannot be neglected. When in trouble as a problem set, the shocks would affect only 2 institutions and 1% of total fund repeatedly for only 2 rounds. Meanwhile, no matter which subset is taken as a problem set, PSBC would not be affected. That is to say, PSBC is almost an isolated node in the banking network.

Liquidity shocks coming from RCCs as a group would affect 4% of all institutions and 6% of total fund repeated for only 2 rounds. Meanwhile, only if large commercial banks are taken as a problem set, RCCs will be affected. This analysis shows RCCs as a subset are relatively isolated in the network.

In general, besides the big four commercial banks, liquidity shocks coming from any individual bank or type of banks as a group would not have a serious impact on the financial network.

2) The second network

If we itemize RCCs as independent network nodes, the network would be characterized as follows: First, RCCs are highly interconnected. Second, possibility that RCCs will be affected would increase. Third, liquidity shocks coming from certain RCCs would affect dozens of RCCs and repeat for 5 – 6 rounds. This shows an obvious partial network interconnectedness between RCCs.

Overall, the authorities should incorporate macro-prudential management into tool box of macro-economic adjustment and financial stability, both drawing on international regulatory reform experiences and tailoring to China's characteristics, to establish relevant regimes:

Establish the system for monitoring, analyzing and assessing soundness of the financial system. The central bank, together with relevant agencies, should enhance macro-prudential analysis, follow the trend of macro-economy and risks, establish an indicators system for monitoring and assessing systemic soundness, and release counter-cyclical prosperity indices/coefficients as guidelines for financial institutions. Financial supervisory agencies should improve supervisory requirements on financial institutions accordingly.

Establish and improve counter-cyclical mechanism of dynamic credit adjustment. In China, credit is the most important way for monetary control and the major composition of bank assets. Credit fluctuation is a typical form of procyclicality in the banking system and a major source of systemic risks. Therefore, PBC and other relevant agencies should innovate new monetary policy instruments based on objective and accurate judgment of the macro-economic situation, conduct timely and flexible counter-cyclical adjustment, establish and improve dynamic provisioning requirement, capital surcharge requirement and counter-cyclical capital buffer linked with extraordinary changes of new loans, smooth credit expansion, direct reasonable growth of credit, and combine aggregates adjustment with financial risks prevention, promoting sound operation of financial institutions while maintaining macro-economic stability.

Improve supervisory system for systemically important financial institutions, markets and instruments. Among potential sources of systemic risks, institutions such as financial holding companies and private equity funds are both the focuses and difficulties for financial supervision. Therefore, establishment and improvement of supervisory system for financial holding companies should be accelerated, and stricter prudential standards including capital and liquidity requirements should be formulated. Financial holding companies should be urged to enhance corporate

governance and risk management, simplify operational structure, lower risk concentration, and control overall risks. The register requirements and information disclosure requirements for private equity funds with assets exceeding certain amount should be clarified drawing on international experience. The principle of combining disciplinary industry regulation and supervisory authorities' guidance should be followed to prevent systemic risks arising from private equity funds and promote normal development of the sector as well.

Establish a diversified and multi-level financial system. A diversified and multi-level financial system is not only conducive to the establishment of the price discovery function of the financial markets, which avoids low trading volume and ineffective pricing caused by highly homogeneous market participants, but also helpful to promote independency and heterogeneity of market participants' behavior, reducing interconnectedness between financial activities and avoiding financial instability arising from herding effects of market participants' behavior. Therefore, it should be encouraged to cultivate a diversified and multi-level system of financial institutions, and develop diversified and heterogeneous financial business models and products to lay a solid foundation for preventing systemic risks.

Enhance cooperation between agencies and effective coordination and supplement between macro-prudential management and micro-prudential supervision. PBC and financial supervisory agencies should coordinate according to division of responsibilities, closely look at movements of macro-economy and functioning of the banking, securities and insurance sectors, conduct researches on risks affecting financial stability and enhance analysis and judgment on systemic financial risks. They should conduct researches on the development of cross-sector and cross-market financial institutions and cross-sector activities and promote coordination between supervisory policies and measures. They should also strengthen cooperation in mitigating and resolving financial risks, enhance information sharing on financial stability, and standardize and institutionalize information sharing. The above mentioned measures ensure that macro-prudential management and micro-prudential supervision have specific focuses and supplement and promote each other as well, which prevents both significant risks of individual financial institutions and systemic risks of the entire financial system.

Deposit insurance should be set up and the economic and financial safety net should be reinforced. Currently, it is the right time for introducing the deposit insurance system in China. Establishing the deposit insurance system is a major institutional arrangement in the financial sector. Accelerating the introduction of the deposit insurance system is not only conducive to recognizing macro-economic policy stances, preventing a new round of creation and build-up of credit risks after credit surge, enhancing coordination between macro-economic management measures, monetary policies and supervisory measures, and directing financial support for steady and

healthy economic growth. Meanwhile, the deposit insurance system is in favor of promoting the cultivation and development of small and medium-sized financial institutions and alleviating financing obstacles of SMEs and agriculture, rural areas and farmers. Therefore, the government should seize the opportunity to establish deposit insurance system to strengthen the market discipline on deposit-taking financial institutions. The limited coverage and differentiated premium rate should be applied to strengthen discipline on too-big-to-fail (TBTF) institutions, supplement to inadequate supervisory resources, and prevent and mitigate financial risks.

Box 20 Measures Taken by Jurisdictions to Enhance Deposit Insurance during the Crisis

Since the outbreak of the global financial crisis, various jurisdictions had taken measures to enhance deposit insurance, aimed at maintaining financial market liquidity, boosting investors' and depositors' confidence and avoiding bank runs. According to the research by IMF and IADI in September 2009, during the crisis, a total of 47 countries have enhanced depositor protection in various ways. Among these countries, 28 chose to raise insurance limits under the deposit insurance systems with limited insurance coverage, while the other 19 provided full deposit guarantee. Among the 28 countries raising insurance limits, 75 percent chose to raise the limits permanently while 25 percent raised them temporarily.

Major measures taken by the above-mentioned jurisdictions include: First, increasing deposit insurance coverage level. US temporarily increased FDIC's deposit insurance coverage level from USD 100 000 to USD 250 000. Countries including Bulgaria and Czech increased the coverage level to 50 000 euros. Countries including Belgium and Spain increased the coverage level to 100 000 euros. Italy announced to provide guarantee for deposits up to 103 000 euros. Russia raised the coverage level to 700 000 Rubles (around USD 23 000). Second, providing full deposits guarantee. US formulated a temporary liquidity guarantee scheme, which provided full guarantee to non interest-bearing bank accounts over USD 250 000 of the insured banks; provided guarantee to senior unsecured debt of the insured banks and other financial institutions in inter-bank markets. Iceland, Denmark, Australia, Hong Kong SAR, Macao SAR, Singapore, Malaysia also announced to provide full guarantee to all deposits. Third, other measures. US resolved failed banks by various means and attempted to attract private capital to resolve failed banks. FDIC issued *Policy Statement on the Acquisition of Failed Institutions*, encouraging private capital to participate in resolution of troubled assets in the US banking sector.

The Indonesia required that the deposit insurance institution under the central bank provide assistance to banks and insurance companies when necessary.

In June 2009, BCBS and IADI jointly published *Core Principles for Effective Deposit Insurance*, laying out 18 principles on establishing effective deposit insurance system. First, to specify appropriate public policy objectives expected to achieve and to mitigate moral hazard through appropriate design. Membership in the deposit insurance system should be compulsory for all financial institutions accepting deposits from those deemed most in need of protection to avoid adverse selection. The level of coverage should be limited and should cover adequately the large majority of depositors. A deposit insurance system should have available all funding mechanisms necessary to ensure the prompt reimbursement of depositors' claims. Second, the deposit insurer should be equipped for early detection and timely intervention and resolution of troubled banks. In order to fulfill their duties, deposit insurance institutions will require access to timely and accurate information from supervisory authorities and the central bank, be able to effectively manage their own risks, be empowered to conduct or require examinations on banks, and be able to provide financial assistance to problem institutions. Third, other issues, such as promoting public awareness of the deposit insurance system, resolving failed financial institutions, and cooperating between deposit insurance institutions and other members in the financial safety net.