Assessment of Systemically Important Banks - A Review

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Abstract

Systemically important bank is an important part of systemically important financial institutions, for the implementation of macro-prudential supervision is based on the effective assessment and recognition of systemically important banks. Assessment over will increase regulatory costs; inadequate assessment will weaken the effectiveness of macro regulation. This paper firstly describes the necessity of systemically important banks assessment; secondly clears connotation and characteristics of systemically important banks; thirdly discusses the importance of systemically important banks assessment from the indicator-based assessment method and model-based assessment method; finally summarizes the systemically important banks assessment.

Keywords: Systemically important banks; Indicator-based assessment method; Model-based assessment method

1. Introduction

In the 2008 outbreak of the financial crisis, the individual financial institutions crisis quickly evolved into a crisis of the entire financial system because many large banks` size and close association with other financial institutions. The rapid spread of crisis made the international financial regulatory agencies fully aware of these "important" banks playing the "important role" in the systemic risk. The financial crisis has shown that financial systemic risk has macro risk characteristics and macro impact. Micro-prudential supervision cannot effectively reduce the bank systemic risk therefore the financial regulatory authority needs the macro-prudential regulation to reduce the huge negative externalities and moral hazard of systemically important banks. A key challenge for the effective implementation of macro-prudential regulation facing is how to assess the systemically important banks. This paper is divided into four parts: the first part is an introduction that points out the necessity to the systemically important banks assessment; the second part clears connotation and characteristics of systemically important banks; the third part discusses the importance of systemically important banks assessment from the index assessment method and model assessment method; finally summarizes systemically important banks assessment.

2. Definition of Systemically Important Banks

US subprime mortgage crisis triggered by the global financial crisis has prompted the generation of Basel III. Systemic risk in the financial system is the core concern of Basel III because systemically important financial institutions play an important role in the crisis. Basel III gradually raised systemically important financial institutions (SIFIs) and systemically important banks (SIBs), causing the domestic and foreign scholars interested in both of them. SIB_s are the key component of SIFIs. The domestic and foreign institutions and scholars are defines SIB in the following ways: the first is emphasizes the size of the SIBs, complexity and system-related degree; the second is to emphasize the key functions of the SIBs undertaken in the financial markets; the third is to emphasize the serious impact disorderly bankruptcy of the SIBs to a region or the financial system and the real economy of a country produces; the four is emphasize the contribution of the SIBs systemic risk to the banking system. Through the above analysis we can see, scholars are more concerned about the disorderly bankruptcy of SIBs bring tremendous impact on the real economy especially its huge negative externalities and moral hazard when they define the SIB_s. SIB_s present the following characteristics:

2.1 Too Big to Fail

SIBs have larger scale compared to other banks which is a problem to the government's implicit guarantee. The collapse of SIB_s would cause the huge adverse impact to the other financial institutions or even the entire financial system and the real economy. The financial crisis is a good example: a series of five US investment bank collapse triggered the financial crisis, in order to reduce the risk of spillover effects caused by closures of financial institutions, the Federal Reserve and the US government rescued Citibank and other SIBs by timely injection of funds in distress.

2.2 Too Association to Fail

The entire banking system became the highly complex financial network. The banks with the different nature occupy the different locations in the financial networks. SIBs in the financial markets trading is very active and form a very close relationship with other banks through lending business, these features decided to SIBs located in the center of the financial network node location, but also makes the systemic risk is easy to spread to other banks or financial institutions from SIBs.

2.3 Too Important to Fail

Systemically important banks not only have the problem of "too big to fail" at the same time has "too important to fail" status, which is mainly reflected in two aspects: first, the existence of a very close relationship systemically important banks and the government. Governments often assume its "lender of last resort" role, will not let it go bankrupt or closed down, so the government's implicit guarantee will further stimulate adverse selection and moral hazard of systemically important banks; second, systemically important banks will use its market dominance to raise prices to reap huge profits, which makes other banks at a competitive disadvantage.

2.4 Too Similar to Fail

Systemically important bank's operations sometimes have the homogeneity feature. Many similar balance-sheet and off-balance-sheet businesses which the same risk of exposure, if one bank failures is likely to lead to a "domino effect", businesses similarity make the risks associated with easy to spread to other financial institutions, causing shocks throughout the financial system. To sum up, we should defined SIBs based on dynamic perspective. The paper defines the SIB_s from the micro-prudential supervision and macro-prudential supervision two dimensions. From the perspective of micro-prudential supervision, SIBs is the banks which means its disorderly bankruptcy will cause huge loss to direct creditors and shareholders of the bank; from the perspective of macro-prudential regulation, SIBs refers to the contribution of these banks is high degree of systemic risk it will not only make disorderly collapse of other financial institutions around the huge losses and threaten the financial system "smooth" function at the same time adversely affect the real economy.

3. Assessment Methods of Systemically Important Banks

Effective assessment and recognition of SIBs is the premise of implementation of macro-prudential supervision. Assessment over will increase regulatory costs; inadequate assessment will weaken effectiveness of macro regulation. From the theoretical point of view, mainly the United States and Britain and other developed countries currently lead the identification and assessment of the global systemically important banks' importance but given the circumstances are different, the assessment of SIBs in all countries can not adopt a "one size fits all" measures. Basel III also recommended that States should combined with the specific circumstances of their local conditions based on the evaluation criteria global systemically important banks, so clear SIBs assessment methods can enrich the theoretical basis of bank regulation. From the point of view of practical significance, in-depth study of assessment of SIBs can measure the bank systemic risk. Effective macro-prudential regulatory measures are taken to reduce the probability of the financial systemic risk. Currently the assessment methods of SIBs mainly divided into indicators-based assessment methods and model-based assessment methods. Indicators-based assessment methods are mainly used by domestic and foreign regulatory agencies policymakers; model-based assessment methods are mainly used by academia.

The two common assessment methods are listed in the following chart:

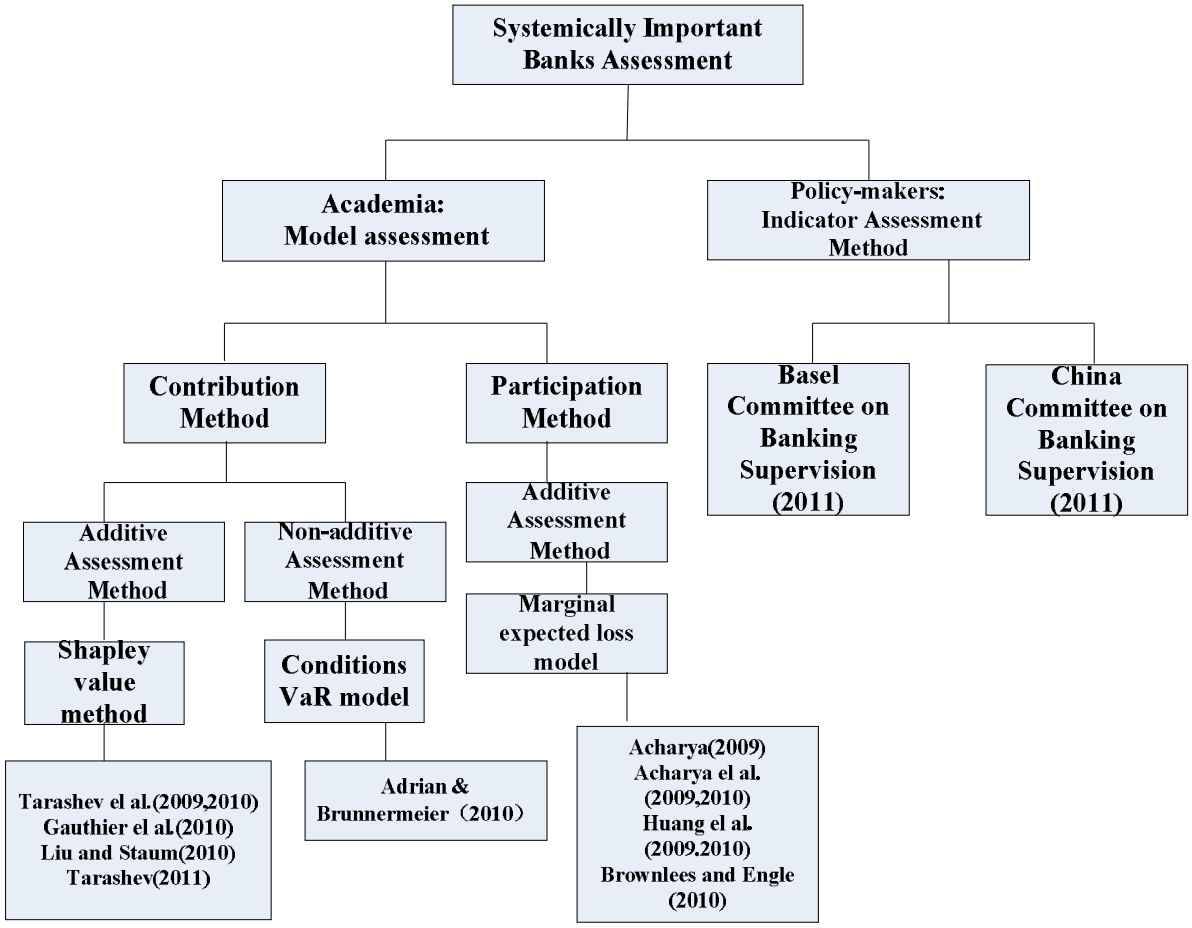

Chart-1: Assessment Methods of SIB_s

Chart source: Bongini P., Nieri L. Identifying and Regulating Systemically Important Financial Institutions. [J]. Economic Notes, 2014, 43(1): 42. (Author made some modifications)

3.1 Indicator-based Assessment Method

Indicator-based assessment method refers to select the various indicators and give appropriate weight to these indicators according to the data results of the bank's balance sheet. The requirements of setting indicators should reflect as much as possible the negative externalities banks from various angles in order to assess the systemic importance of banks.

In January 2009 International Monetary Fund (IMF) and Banking Research Center (ICMB) classified systemic importance of financial institutions from the angle of the financial risk diffusion. In March 2009 UK Financial Services Authority (FAS) assessed SIB_s according to three aspects: scale, relevance and kinds. In November 2009 International Monetary Fund (IMF), Bank for International Settlements (BIS), Financial Stability Board (FSB) jointly issued the "Systemically Important Financial Institutions Assessment Guide" assess $SIFI_s$ from the direct and indirect effects: direct impacts mainly consider the size and alternative of financial institutions; indirect impacts main consider the association among of financial institutions. Thomson (2009) proposed should assessment $SIFI_s$ from five aspects such as scale, infectious, concentration, correlation, and environmental assessment. Basel Committee on Banking Supervision (BCBS, 2010) used scale indicators, related indicators and substitutability indicators to assess $SIFI_s$, the kinds of evaluation framework to get more consistent recognition. In March 2010 macro-prudential group under the Basel Committee (PMG) added the activity and complexity of the global index and divided the benchmark index into the evaluation indicators (scale indicators, relevance indicators) and complementary indicators (available alternative complementary indicators, relevance supplementary indicators, global business supplement indicators).

The assessment indicators determined the basic score of single bank; national regulatory authorities adjusted the basic score according to their complementary indicators. In July 2010 MPG proposed indicators system with the combination of subjective judgment and divided $SIFI_s$ into 5-7 class according to the degree of importance to financial institutions. In July 2011 BCBS proposed the method to assess the SIB_s from the five aspects: multi-jurisdictional activity jurisdictions, scale, relevancy, substitutability and the complexity. In November 2011 FSB and BCBS used these five indicators system for assessment of the 73 global banks according to size and identified 29 global SIB_s. Assessment methods and the list of global SIB_s are not immutable. BCBS decided to collect date of large banks around the world from November 2011 for three consecutive years and announced the list of global SIB_s again before November 2014 and prepared to make the necessary changes and adjustments to the assessment methods before 2017 November.

Indicator-based assessment method is more intuitive; creates multiple indicators and gives corresponding weights according to the importance of every bank in the banking system from multiple angles, using the indicator-based method to assess the importance of the banking system is easy to operate, according to available the data of listed banks can more easily obtain relatively dynamic sort list, so using this method can trace the source of timely importance of the banking system and future trends. However, due to simple indicators design and strong subjectivity, it will affect the selection of indicators and weights given, so the result obtained due to the influence of subjective willingness often vary, the lack of uniform standards for each bank the contribution of systemic risk analysis is not deep enough.

3.2 Model-based Assessment Methods

Model-based method is academia commonly used assessment method, model-based assessment method based on financial risk management model, analyzes several banks involved in trading in financial markets contribution to systemic risk, so as to give different degree of SIB_s. The more popular models include: financial network model, condition value at risk model (CoVaR), extreme value theory model (EVT), Shapley value method (Shapley Value) and marginal expected loss model (MES), and so on.

3.2.1 Financial Network Model

Financial Network is combination of nodes formed by bank liquidation and credit. Financial network model through the establishment of the bank's financial network matrix, using the simulation method based on the bank's financial data liquidation payment relationship between banks and simulate the risk transmission between banks "domino effect". If the simulation results of a bank exceed such preset threshold, the bank is considered as systemically importance bank.

Eisenberg and Noe (2001) as well as Elsinger, Lehar and Summer (2006) developed a method for tracking the impact of vector credit risk shocks, vector algorithm can simulate a single inter-bank market or more events of default, thus these trigger events of default probability estimate for systemic risk, if a bank's default caused losses of more than a preset threshold, the bank is considered as SIB. Muller (2003) used network analysis and simulation investigating credit and liquidity effects on infectious between Swiss banking risk. Upper (2007) used financial network analysis methods to measure the extent contact the location of a single bank in the financial network, a bank located in a more central position of the bank network is defined as SIB. Nier et al (2008) and Gai and Kapadia (2008) built banking system simulation network to study how affects a hypothesis of elastic shock to bank networks. Research results showed that: the impact of external shocks on the inter-bank mutual probability obvious, from this perspective, the financial system has certain robustness; but the banking system has a corresponding vulnerability because of high correlation between banks; the researchers found that non-linear effects of bank net worth and network Associates (loans among banks) to infection.

Brock, Homes and Wagener (2009) established financial network risk model relying on the risk exposure of financial institutions interconnected matrix; used simulation to analyze the impact of the contagion effect of the financial system to assess the $SIFI_s$. Drehmann and Tarashev(2011) using the generalized Contribution Approach (GCA) analysis of the results showed that: the location of a bank in the financial network determines the importance of the bank. Advantages of financial Network model assessment method is to consider the banking system as a complex and dynamic network focus on correlation analysis between banks, and therefore this method can measure the business relationship between banks clearly, and can measure "domino effect" of bank risk infection, and can assess the potential of SIB_s.

The drawbacks of this model are the followings: firstly, it is very difficult to obtain the relevant data because the bank's risk exposure data are often subject to strict confidentiality States banking regulatory agencies; secondly, the range of analyze is limited, domestic and foreign scholars use financial network mainly study on the bank credit markets and the importance of balance-sheet risk, don't pay much attention on bank scale, and therefore the validity of analysis results may be limited; thirdly, in practice, the risk of transmission in the financial network speeds faster, thus using financial network model to analyze the results of timeliness may be limited.

3.2.2 Condition Value at Risk Model (CoVaR)

Conditions VaR model by tracking how the price risk of bank' securities changes with another bank in the risk control and changes the risk factors after research collaboration of a bank, to analyze the interdependence of banks' systemic risk, and then measures the systemic importance of banking system. The use of this assessment method handle three important factors: the first is the size of banks; the second is the leverage ratio; the third is maturity mismatches.

Adrian and Brunnermeier (2009) calculated the risk value at risk (CoVaR) of a financial institution under stress conditions (fall into a crisis condition), based on the difference (ΔCoVaR) between value at risk (CoVaR) and normal condition of the entire financial system Value at Risk(VaR) to measure the marginal contribution of individual financial institutions to systemic risk, in order to assess the level of importance of each financial institution. Adrian and Segoviano et al (2009) measured the systemic importance of a single bank through analyzing the probability of a bank insolvency crisis cause other banks to bankrupt. Brunnermeier (2010) adopted quantile regression to calculate Δ CoVaR on the basis of 1269 financial institutions data. The study not only has realized to list the importance of financial institutions but also to consider the CoVaR quantile regression coefficient as the basis for different additional capital for $SIFI_s$, thus to solve the problem of the pro-cyclical effect. Adrian and Brunnermeier (2010) obtained the results by empirical analysis: there is an inverse relationship between forward Δ CoVaR and spot Δ CoVaR, so it can consider forward Δ CoVaR as counter-cyclical regulatory tools. Zhou (2010) proposed "Systemically Important Index (SII)" and "Vulnerability Index(VI)" based on the condition risk model to assign a single institution contribution to the systemic risk. The research has practical significance, not only analyzes the systemically important of the financial institutions from two points of view and also considers scale and default risk of single financial institutions. Roengpitya (2010) used the CoVaR method to analyze systemic risk of the Bank of Thailand and the risk spillover effects of individual banks in empirical analysis. Empirical results showed that: after the Asian financial crisis era, the contribution of a single financial institution for the entire systemic risk raised and showed a positive correlation with the size of assets. Mistrulli (2010) assessed the systemically importance of the Italian banking system according to financial data bank affiliates.

Conditions VaR model assessment method capable of more in-depth analysis for the contribution of individual financial institutions on financial systemic risk, to relax the conditions of using financial data, financial data presented even if these spikes or even the existence of fat tails heteroscedasticity. This model using data acquisition is relatively simple, relatively simple empirical operation. However, there are some flaws of CoVaR model method: Buiter (2009) study pointed out CoVaR assessment methods belong to correlation analysis, but the risk of spillover effects of financial institutions implied causality, the two are not the same. In addition CoVaR is a means to measure the direct risk, there will be a big difference under the performance of financial institutions in crisis and non-crisis period, the measure effect of indirect risks may not be ideal. Tarashev (2010) pointed out that a single institution's contribution to systemic risk and the total sum of systemic risk is not equal so the CoVaR don't additive. Gauthier and Lehar (2010) also pointed out that the risk of various financial institutions was calculated overflow does not equal to the total systemic risk.

3.2.3 Extreme Value Theory Model (EVT)

Extreme value theory model uses extreme value method to measure the contribution of individual financial institutions to systemic risk, which mainly uses extreme case analysis lead to the probability of a bankruptcy of financial institutions and other financial institutions collapse. This method not only concerns SIB_s ranking, but also focuses on the contribution of a bank to systemic risk. Early used Value at Risk (VaR) is estimated in the unvariate extreme value model, Hartmann, Straetmans and Vries (2005) used a multivariate extreme value model to measure the bilateral relations of the banking system. Zhou (2008) first proposed EVT concept in 2010, extended bivariate analysis to multivariate EVT.

Segoviano and Goodhart (2009) adopted "Systemic Impact Index (SII)" and "Vulnerability Index (VI)" to measure the systemically importance of the banking system, the analysis concluded that: SII index more effective than VI index, the relationship between size and systemic importance of financial institutions is not significant. Peeters (2011) applied bank size and market value to built "Collateral Damage Index (CDI)". The study results supported the Tarashev et al. (2009) and Acharya (2009) point of view, the size and SIB_s correlation exists but cannot be equated.

Extreme value theory model takes advantage of publicly listed bank transactions date, therefore the cost of collecting information is relatively low and easy to operate in practice. EVT can be used to predict extreme events in the middle level of data modeling, financial institutions, the financial crisis caused by the tail of the event a crisis situation does not reach to estimate, to solve the problem of estimation of data, but the defect is only considered EVT distribution tail.

3.2.4 Marginal Expected Shortfall Model (MES)

Expected shortfall (ES) on behalf of the systemic risk of financial institutions, marginal expected shortfall (MES) is the first derivative systemic risk of financial institutions about the weight of individual financial institutions, on behalf of expected losses of individual financial institutions in times of crisis, but also uses MES to indicate that the sensitive degree the risk of financial system to a single financial institution changes, and evaluates the systemic importance of individual financial institutions. MES estimation method is also different according to different indicator set.

Acharya (2009) proposed the marginal expected loss model and used systemic expected shortfall (SES) to predict systemic risk of financial institutions and estimate the systemic importance of individual institutions. Acharya et al. (2010) used the actual stock losses of financial institutions on behalf of the crisis of systemic expected shortfall (SES) during the crisis period through measuring the relationship between the performance of SES and crisis marginal expected loss under the worst condition of 5% (MES) to predict systemic risk. The results showed that: the financial expected loss with the financial leverage of financial institutions and expected losses of systemic distribution tail loss function presented positive correlation. Brownlees and Engle (2011) proposed systemic risk indicator (SRI) on the basis of Acharya et al. The indicator combined leverage factors and marginal expected loss factors in order to measure the systemic importance of financial institutions using sample forecasting methods. Banulescu et al (2012) applied directly the scale factor to the MES method and developed an improved method of MES --- ingredient expected shortfall (CES) method. This method measured the systemic importance of financial institutions by calculating the contribution percentage the systemic risk of a single financial institution to the entire financial systemic risk. Huang (2010) pointed out that aggregation of the marginal contribution of each bank to systemic risk is systemic risk for the entire banking system, the marginal contribution of individual Banks is expected losses of the banks in the crisis period.

The advantages of MES models to assess the systemic importance of the banking system are the followings: first is relatively easy to obtain the data, and you can use the open market and the date of the transactions; second is that the model can be calculated for the percentage contribution of each institution to systemic risk and listed the SIB_s; third is that the model is able to measure the expected loss of financial institutions when extreme event occurs, to overcome the insufficient of VaR model is concerned only with a certain degree of confidence in the case of sub-sites. But the disadvantage of this method is that the assessment does not reflect the risk characteristics of a number of individual financial institutions such as the size and extent of the leverage; in addition MES model does not additive features, i.e. the expected shortfall of overall financial institutions is not equal to the total of marginal expected shortfall of every financial institutions.

3.2.5 Shapley Value Method (Shapley Value)

Lloyd Shapley (1953) propose a method based on Shapley value of cooperative game theory, the idea of this method is to measure the degree of individual to the overall in according with individual contribution value to the overall, so you can use Shapley value method to assess the systemic importance of individual financial institutions by measuring the extent of the contribution of individual financial institutions to the systemic risk of entire financial system. We can use the VaR and the ES of financial system to measure the systemic risk. The Shapley value of single financial institution represents its systemic importance. Tarashev, Borio and Tsatsaronis (2009) applied Shapley value method to assess the systemic importance of banking system. They transformed the measurement of systemic importance into the problem of individual banks assign systemic risk.

They believed that the risk contribution of bank system consists of two parts: one part is the contribution of itself to systemic risk after in trouble; the other part is the loss caused to other banks after itself in trouble. So they putted systemic risk allocation to each bank among all banks according to the risk contribution of each bank. The sum of every bank's Shapley value equals to systemic risk, so we can use Shapely value method to measure SIB_s. Tarashev, Borio and Tsatsaronis (2010) continued to use the Shapley value method to assess the $SIFI_s$, they pointed out that the risk of a single financial institution, single financial institutions of common risk exposure and the scale of financial institution concentration are the key factors influencing the $SIFI_s$. Drehmann and Tarashev (2011) used Shapley value method to measure the systemic importance of the banking system. The study showed that the macro-prudential regulation can reduce systemic risk.

The advantage of Shapley value method has the additive feature. The sum of Shapley contribution value of single bank equals to the systemic risk of banking system. Shapley value presents a good assessment methods and mechanisms that can help banks how to assign according to marginal contribution to systemic risk. Each bank is the "participant" of financial business, using Shapley method can measure the value of each "participants" and to assess the systemic importance of individual bank, but Shapley value method only considers the risk contribution of the individual banks in the banking system, without considering the contribution of a bank to other banks so this approach ignores the complexity of bilateral relations between banks.

IV Summary and Outlook

This article summarizes the assessment methods of SIB_s. Summary and Outlook derived through analysis of these assessment methods are as follows:

1. Assessment methods are mainly two kinds: indicator-based method and model-based method, the users of indicator-based assessment method is mainly policy makers of international regulatory bodies. This method is the international regulatory experience summary with the feature of simple and fast. The users of model-based assessment method are mainly domestic and foreign academics. This method measures the systemic importance of financial institutions through the analysis of the contribution of single financial institutions to systemic risk based on financial institutions risk measurement model.
2. Effective assessment of SIB_s is the premise of the implementation of macro-prudential regulation policy. In order to reduce the possibility of systemic risk in the banking sector the supervisors should strengthen macro-prudential supervision of SIB_s. The effective assessment of SIB_s affects the potency of macro-prudential supervision policy. Assessment over will increase regulatory costs; inadequate assessment will weaken effectiveness of macro regulation.
3. In the context of a rapidly changing of financial environment, the relationship of the banking system has become increasingly complex and less transparent, systemic risk will change with vary of the financial environment and financial network structure. If the supervisors want to accurately portray the contribution of a single bank to the systemic risk they need a dynamic vision to treat the assessment of the systemic importance of the banking system. Therefore, the banking system cannot be absolutely divided SIB_s and non-SIB_s, and the list of SIB_s need to timely adjust dynamically. Banking system can be divided into independent SIB_s, part SIB_s, non- SIB_s parts based on the degree of systemic importance of each bank in order to implement the differential regulation.
4. The assessment of SIBs has no common pattern and methods. Each type of assessment methods has advantages and disadvantages. Therefore every country must select the appropriate assessment methods combined with its actual situation. For the developing countries such as China mainly use the indicator-based method due to the limitation and deficiency of bank data. With the continuous collection of bank data and the improvement of financial market, the supervisors can the combination method of indicator-based method and model-based method in order to improve the credibility of the assessment results.
5. Deeply realize the true meaning behind the assessment of SIB_s: the assessment of SIB_s doesn't to create a list of SIB_s. The implementation of macro-prudential supervision policy is to eventually make the banks exit from the list of SIB_s. The aim of the assessment of SIB_s is to reduce this bank's moral hazard and reduce the occurrence probability of the systemic risk, to ensure the steady and healthy development of the banking system.

References

Acharya, Viral V. and Pedersen, Lasse Heje and Philippon, Thomas and Richardson, Matthew P., 2010. "Measuring Systemic Risk". AFA 2011 Denver Meetings Paper.

Adrian T, Brunnermeier M. 2010. "CoVaR Federal Reserve Bank of New York". Staff Reports.

Adrian T, Brunnermeier M. 2011. "CoVaR". National Bureau of Economic Research.

BCBS. 2010. "The Basel Committee`s Response to the Financial Crisis: Report to the G20".

BCBS. 2011. "Global Systemically Important Banks: Assessment Methodology and the Additional Loss Absorbency Requirement". Basel Committee on Banking Supervision.

Brock W, Hommes C, Wagener F. 2009. "More hedging instruments may destabilize markets". Journal of Economic Dynamics and Control, 33(11): 1912-1928.

Brownlees C T, Engle R F. 2012. "Volatility, correlation and tails for systemic risk measurement". Available at SSRN 1611229,

Buiter, Willem. 2009. "Lessons from the global financial crisis for regulators and supervisors". Discussion paper, 635. Financial Markets Group, London School of Economics and Political Science, London, UK.

China Banking Regulatory Commission. 2011. "Guiding Opinions on the Implement of China`s banking regulatory standards". No. 44 [Z].

Drehmann M, Tarashev N. 2011. "Systemic importance: some simple indicators". BIS Quarterly Review.

Dumitrescu E, Banulescu D G. 2012. "Which are the SIFIs? A Component Expected Shortfall (CES) Approach to Systemic Risk". Working Paper.

Eisenberg L, Noe T H. 2001. "Systemic risk in financial systems". Management Science., 47(2): 236-249.

Elsinger H, Lehar A, Summer M. 2006. "Systemically important banks: an analysis for the European banking system". International Economics and Economic Policy, 3(1): 73-89.

FAS. 2009. "A regulatory response to the global banking crisis: systemically important banks and assessing the cumulative impact". Financial Service Authority Discussion paper No.09/2:1-206

Gai P, Kapadia S. 2010. "Contagion in financial networks". Proceedings of the Royal Society A: Mathematical, Physical and Engineering Science, rspa20090410.

Gauthier C, Lehar A, Souissi M. 2010. "Macroprudential regulation and systemic capital requirements". Bank of Canada Working Paper.

Hartmann P, Straetmans S, De Vries C G. 2005. "Banking system stability: A cross-Atlantic perspective". National Bureau of Economic Research.

Huang X, Zhou H, Zhu H. 2009. "A framework for assessing the systemic risk of major financial institutions". Journal of Banking & Finance, 33(11): 2036-2049.

IMF, BIS, FSB. 2009. "Guidance to Assess the Systemic Importance of Financial Institution, Markets and Instruments: Initial Considerations, Report to G20".

Müller J. 2003. "Two approaches to assess contagion in the interbank market". Swiss National Bank .

Mistrulli P E. 2011. "Assessing financial contagion in the interbank market: Maximum entropy versus observed interbank lending patterns". Journal of Banking & Finance, 35(5): 1114-1127.

Nier E, Yang J, Yorulmazer T, et al. 2007. "Network models and financial stability". Journal of Economic Dynamics and Control, 31(6): 2033-2060.

Peeters R. 2011. "Quantifying systemic importance: An extreme value approach". [D]. Master Thesis, Maastricht University,

Roengpitya R, Rungcharoenkitkul P. 2011. "Measuring systemic risk and financial linkages in the Thai banking system". Bank of Thailand Discussion Paper, 2: 2010.

Segoviano M, Goodhart C. 2009. "Bank stability measures". IMF, WP/09/4.

Tarashev N, Borio C, Tsatsaronis K. 2009. "Allocating systemic risk to individual institutions: methodology and policy applications". Bank for International Settlements. Working Paper.

Tarashev N, Borio C, Tsatsaronis K. 2010. "Attributing systemic risk to individual institutions". Bank for International Settlements.

Upper C. 2007. "Using counterfactual simulations to assess the danger of contagion in interbank markets". Bank for International Settlements .Working Paper.

Zhou C. 2010. "Are banks too big to fail? Measuring systemic importance of financial institutions". International Journal of Central Banking, 6(4): 205-250.