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วรรณวิมล สว่างเงินยวง สายนโยบายการเงิน
สุกฤตา สงวนพันธุ์ สายนโยบายการเงิน
วรวิทย์ ทรัพย์บริบูรณ์ สายนโยบายสถาบันการเงิน*

ข้อคิดเห็นที่ปรากฏในบทความนี้เป็นความคิดเห็นของผู้เขียน
ซึ่งไม่จำเป็นต้องสอดคล้องกับความเห็นของธนาคารแห่งประเทศไทย

บทคัดย่อ

หลังวิกฤตการเงินโลก ปี 2550 ธนาคารกลางทั่วโลกให้ความสำคัญกับการดูแลเสถียรภาพระบบการเงินมากขึ้น เนื่องจากบทเรียนจากวิกฤตการเงินนี้ชี้ให้เห็นว่า แม้ว่าสถาบันการเงินจะถูกกำกับดูแลตามหลักเกณฑ์และมาตรฐานสากล เศรษฐกิจขยายตัวดี มีอัตราเงินเฟ้อต่ำ แต่วิกฤตการเงินก็ยังสามารถเกิดขึ้นได้ และมีความรุนแรงขึ้นในระยะหลัง เนื่องจากระบบการเงินยุคนี้มีขนาดใหญ่ มีความซับซ้อน และเชื่อมโยงกันมากขึ้น ทำให้ปัญหาของสถาบันการเงินหนึ่งสามารถกลายเป็นปัญหาของทั้งระบบการเงินได้อย่างรวดเร็ว ธนาคารกลางในฐานะผู้รักษาเสถียรภาพระบบการเงินจึงมีบทบาทสำคัญ ทั้งในส่วนของกำกับการป้องกันวิกฤตและการเข้าช่วยเหลือสถาบันการเงินในยามวิกฤต

บทวิจัยนี้ชี้ให้เห็นว่า ในช่วงวิกฤตการเงินโลกที่ผ่านมา ธนาคารกลางหลายแห่งทั่วโลกมีวิธีการเข้าช่วยเหลือสถาบันการเงินที่ประสบปัญหาในรูปแบบที่แตกต่างไปจากในอดีต โดยธนาคารกลางหลายแห่งมีการนำเครื่องมือใหม่ๆ มาใช้ในการแก้ไขปัญหา ตลอดจนมีการขยายขอบเขตการเข้าช่วยเหลือไปยังสถาบันการเงินที่ไม่ได้อยู่ภายใต้การกำกับดูแลโดยตรง มิติใหม่ที่เกิดขึ้นนี้นำไปสู่ความท้าทายของธนาคารกลางในระยะต่อไป ทั้งในด้านการประเมินความเสี่ยง การกำกับดูแลเพื่อลดความเสี่ยง และการกำหนดนโยบายที่เหมาะสม ตลอดจนนำไปสู่การเขียนนโยบายต่อธนาคารแห่งประเทศไทยเอง ในฐานะผู้ดูแลเสถียรภาพระบบการเงินไทย

* คณะผู้วิจัยขอขอบคุณ ดร. ปฤษันต์ จันทน์หอม ผู้อำนวยการ ฝ่ายวิจัยเศรษฐกิจ สำหรับข้อเสนอแนะและแนวคิดที่เป็นประโยชน์อย่างมาก ซึ่งมีส่วนช่วยให้บทความมีความสมบูรณ์ยิ่งขึ้น นอกจากนี้ ผู้เขียนขอขอบคุณ คุณสุชาติ ภิระกุล รองผู้ว่าการ ด้านเสถียรภาพการเงิน คุณไพบุลย์ กิตติศรีกังวาน ผู้ช่วยผู้ว่าการ สายนโยบายการเงิน คุณเมธี สุภาพงษ์ ผู้อำนวยการอาวุโส ฝ่ายนโยบายเศรษฐกิจการเงิน คุณจันทวรรณ สุจริตกุล ผู้อำนวยการอาวุโส ฝ่ายเศรษฐกิจระหว่างประเทศ ดร. ปิติ ดิษยทัต ดร. ชญาวดี ชัยอนันต์ และ ดร. รุ่งพร เริงพิทยา สำหรับข้อชี้แนะที่เป็นประโยชน์ รวมทั้งผู้บริหารและเจ้าหน้าที่ในสายนโยบายการเงินและสายนโยบายสถาบันการเงิน ธนาคารแห่งประเทศไทย สำหรับข้อคิดเห็นและคำแนะนำ หากมีข้อผิดพลาดประการใด ผู้วิจัยขอน้อมรับไว้ ณ ที่นี้



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Financial Systemic Stability: Challenging Aspects of Central Banks

WANVIMOL SAWANGNGOENYUANG

SUKRITA SA-NGUANPAN

WORAWUT SABBORRIBOON*

The views expressed in this paper are those of the authors and do not necessarily represent those of the Bank of Thailand

Abstract

Since 2007 global financial crisis, many central banks have tended to focus on financial stability much more than ever. Lessons learned from recent crises witness that in a period of sustained economic growth with low and stable inflation, financial imbalances could adversely affect financial system and real economy, which eventually leads to financial crises. In addition, the cost of crises becomes increasingly expensive over time because crises themselves have been more systemic. Risk from one financial institution can easily transfer to others and then to the whole financial market. Thus, current crises highlight the importance of financial stability role of central banks in two main aspects, crisis prevention and crisis management.

The paper indicates that in recent financial crises, many central banks have stepped beyond their traditional roles in order to ensure financial system stability. Some instruments and measures that central banks have implemented can be considered as unconventional ones. Looking forward, these practices then lead to new challenges for central banks in three main aspects: risk identification, risk mitigation, and policy issuance process. Eventually, this paper also provides policy implications to Bank of Thailand, based on international experiences and lessons learned from recent crises.

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Section 1: Introduction

Central banks generally have two core objectives, monetary stability and financial stability. These two main functions complement each other. The first objective is to stabilize the general price level, while the second one is to stabilize the key financial institutions and markets. Nowadays, the concept of monetary stability has progressed further than in the case of financial stability. No one disputes that maintaining price stability is an appropriate objective of monetary policy. On the other hand, there is still no general consensus for the concept of financial stability.

Since 2007 global financial crisis, many central banks have tended to focus on financial stability much more than ever. Lessons learned from recent crises witness that in a period of sustained economic growth with low and stable inflation, financial imbalances could adversely affect financial system and real economy, which eventually leads to financial crises. In addition, the cost of crises becomes increasingly expensive over time because crises themselves have been more systemic. Risk from one financial institution can easily transfer to others and then to the whole financial market. Besides crises themselves, failure in crisis management also causes financial crises much more costly.

In the paper, we review instruments and policy that central banks have implemented in order to ensure financial stability in two main aspects, crisis prevention and crisis management. Specifically, we highlight some concerning issues, comprising coordination between central banks and associated organizations and burden sharing. Furthermore, we provide policy implications to the Bank of Thailand, based on international practices and lessons learned from recent crises.

The rest of this paper is organized as follows. Section 2 gives a short overview of the concept of financial stability, systemic-crisis-prone financial system, and historical development of central banks' financial stability role. Section 3 briefly discusses crisis prevention, mainly focusing on macro-prudential policy and its coordination with monetary policy. Section 4, which contains the core of the paper, explores crisis management, including lender of last resort function and resolution process. In addition, burden sharing in crisis management is certainly discussed. The last section then offers policy recommendations to the Bank of Thailand.

Section 2: Overview of Financial Stability Issues

2.1 The Definition of Financial Stability

Although financial stability is one of the central banks' main objectives, there is still no general consensus for the concept of financial stability until recently. Particularly, there is no universally precise and explicit definition of financial stability. Some interesting definitions defined by various economists are as follows, and most often the opposite concept, financial instability, is used instead.

Bernanke and Gertler (1990) state that financial instability, or fragility, occurs when entrepreneurs who want to undertake investment project have low net worth; the heavy reliance on external finance causes the agency costs of investment to be high. High agency costs in turn lead to low and inefficient investment.

Crockett (1997) takes financial stability to apply to both institutions and markets. In other words, stability requires (1) that the key institutions in the financial system are stable, in that there is a high degree of confidence that they can continue to meet their contractual obligations without interruption or outside assistance; and (2) that the key markets are stable, in that participants can confidently transact in them at prices that reflect fundamental forces and that do not vary substantially over short periods when there have been no changes in fundamentals. Thus, stability in financial institutions means the absence of stress that has the potential to cause measurable economic harm beyond a strictly limited group of customers and counterparties while stability in financial markets means the absence of price movement that causes wider economic damage.

Schinasi (2004) states that financial stability is a condition in which an economy's mechanisms for pricing, allocating, and managing financial risks (credit, liquidity, counterparty, market, etc.) are functioning well enough to contribute to the performance of the economy.

Allen and Wood (2006) define episodes of financial instability as episodes in which a large number of parties, whether they are households, companies, or (individual) governments, experiences financial crises which are not warranted by their past behaviors, and where these crises collectively have seriously adverse macro-economic effects. Then, they define financial stability as a state of affairs in which financial instability is unlikely to occur, so that the fear of financial instability is not a material factor in economic decisions taken by individuals or businesses.

According to Rosengren (2011), financial stability reflects the ability of the financial system to consistently supply the credit intermediation and payment services that are needed in the real economy if it is to continue on its growth path. On the other hand, financial instability occurs when problems (or concerns about potential problems) within institutions, markets, payments systems, or the financial system in general significantly impair the supply of credit intermediation services – so as to substantially impact the expected path of real economic activity. To sum up, his definition of financial instability has three key elements: problems in the financial system, impairment of intermediation (or the supply of it), and a substantial impact on the real economy.

Although no rigorous definition of financial stability exists, there is wide agreement among economists that financial stability is the condition in which financial system functions well enough to support the performance of the economy. Moreover, it is worth noting that some definitions deal with prevention as much as with cure. This implies that central banks should not only be able to respond to a crisis, but also to prevent them from happening.

2.2 The concept of systemic-crisis-prone financial system

As mentioned earlier, recent financial crises have been increasingly systemic. Leon et al (2011) characterize that there are three main elements that make financial system highly prone to systemic crisis: Complexity, Homogeneity, and Opaqueness.

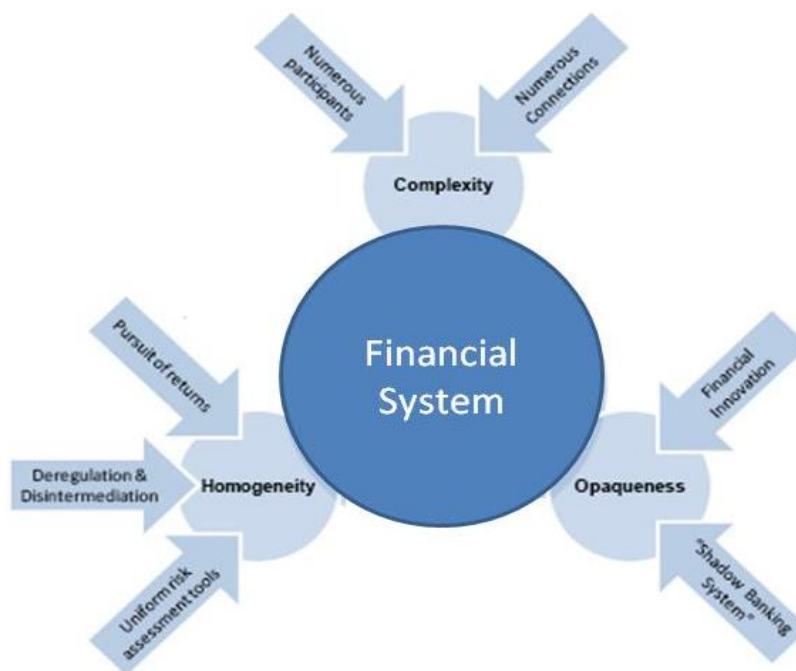
Complexity is the first element. As stated by Landau (2009), the financial system, which is based on the interdependence between multiple actors and counterparties, can be seen as a complex system. This type of system, which is characterized by numerous participants and connections between participants, is difficult to observe and analyze. Additionally, although complex system may take advantage of risk dispersion as the existence of numerous participants allows for different holdings and strategies, this advantage can be vanished owing to the second element, homogeneity.

Homogeneity is another element. If all participants implement the same tools and strategies with identical objectives, connectivity may not serve the purpose of risk dispersion, but amplification. Leon et al (2011) summarize that a sharp decrease in diversity in current financial system results from three main reasons: (1) pursuit of returns (2) deregulation and disintermediation (3) uniform risk assessment tools.

The last element is opaqueness. Nowadays, opaqueness in financial system is mainly due to shadow banking system, whose members are not subject to supervisory and regulatory

oversight. Moreover, financial innovations such as securitization also make financial system more opaque.

Figure 1: An increasingly systemic-crisis-prone financial system



Source: adapted from Leon et al (2011)

In conclusion, the sum of these three elements: complexity, homogeneity, and opaqueness finally lead the financial system highly prone to systemic financial crisis. The concept of an increasingly systemic-crisis-prone financial system is summarized in Figure 1.

2.3 The Development of Financial Stability Role of Central Banks

Albeit the concept of monetary stability has recently developed further by tracing the historical development of central banks' role, it seems interesting that the primary role of central banks firstly developed in the context of financial stability rather than monetary stability. Dating back to 1793, the war's outbreak between Britain and France caused a shortage of liquidity in the British banking system. At that time only the Bank of England, as the monopoly of note issue, could provide the necessary cash. Sir Francis Baring (1979) then referred to the Bank of England as the *dernier resort*, which became the origin of the concept of the lender of last resort (LOLR) afterwards.

According to Goodhart and Tsomocos (2010) , the earliest banks that eventually transformed into central banks, such as the Riksbank, the Bank of England, and the Banque de France, were initially established to provide certain banking and financial services to the government, notably including the provision of funding during war time. In return they received certain competitive and governance advantages that quickly enabled them to become the largest commercial bank in their own country. As a result of their central role, they had both a complementary relationship, especially with the smaller country banks, and also a competitive relationship, especially with the larger joint-stock banks (Goodhart and Tsomocos, 2010). Given competitive advantages, the central bank was a significant competitor to the other commercial banks during the nineteenth century. Consequently, the idea that the central bank should have supervision of the commercial banks became unacceptable. This situation finally turned the central bank into public sector, in return for the right to supervise financial institutions directly.

During the nineteenth century, it is apparent that most central banks, as a liquidity provider, performed well to prevent banking failures. However, we have seen that the financial crises occurred more frequently in the twentieth century. Additionally, their impacts on economy are becoming more severe than before. Some economists argue that the key reasons behind these situations are increasing complexity and connectivity among players in the financial system.

To sum up, albeit financial instability in the past arising from a liquidity shortage can be dealt with classical LOLR action- lending freely at a penalty rate against sound collateral to illiquid but solvent banks, it seems that in the last few years merely traditional LOLR is not sufficient to prevent banking failures. Recent crises have been more systemic. This circumstance eventually leads to more unconventional actions from central banks in recent years.

Section 3: Crisis prevention

The recent global financial crises illustrate the shortcoming of the current supervision practices in dealing with the build-up of financial imbalances whose sudden unwinding will have severe macroeconomic consequences. Supervisors fail to address the imbalances partly due to too much reliance on micro-prudential policy by assuming that the failure of one financial institution will not spread to other financial institutions as long as it has high buffers and well diversified portfolios. However, the recent crises highlight that the failure of one institution can spread out very quickly and become systemic crises in very short time; hence, supervisors should go beyond a micro-prudential policy to more macro perspective which is known as macro-prudential policy. The notion macro-prudential, though was first used in 1970s, starts to get more attention right after the recent crises. In this section, we will focus on macro-prudential policy and the related issues. We will start with the discussion about the distinction between micro-prudential policy and macro-prudential policy, and the shortcoming of micro-prudential policy. We then move on to discuss whether monetary policy can be used to stabilize financial system. Lastly, we will discuss about the key challenge of balancing between monetary policy and macro-prudential policy for efficient supervision on financial systemic stability.

3.1 Distinction between micro-prudential policy vs. macro-prudential policy

Micro-prudential policy refers to the monitoring on one specific financial institution to make sure that each financial institution operates safe and sound with enough buffers, while macro-prudential policy focuses on the safe and soundness of the financial system as a whole. As a result, the micro-prudential policy and macro-prudential policy differ in terms of objective and the model used to describe risk (Table 1). The objective of the micro-prudential policy is to limit the impact of financial distress of each individual institution, regardless of its impact on the economy, whereas that of macro-prudential policy is to limit the impact of financial distress on the output of the economy as a whole. As for the model that used to describe risks, the micro-prudential policy assumes that the risks are exogenous as the supervisors focus on individual financial institution, whilst macro-prudential policy assumes that risks are in part endogenous with respect to the behaviour of the financial system. Lastly, with regards to imposing prudential controls, the macro-prudential policy is a top-down approach. It, first, sets the relevant threshold of acceptable tail losses for the aggregate portfolio of individual institution, and then calibrates the prudential controls on the basis of the marginal contribution of each

security to the relevant measures of portfolio risks. Contrarily, micro-prudential policy is a bottom-up approach. It sets prudential controls in relation to the risks of individual institution. Hence, the movement of each institution's portfolio is ignored.

Table 1: The distinction between macro-prudential policy and micro-prudential policy

	Macro-prudential policy	Micro-prudential policy
Objective	Limiting financial system-wide distress	Limiting distress of individual institution
Risk model	Endogenous (depend on collective behavior)	Exogenous (independent of individual institution behavior)
Correlations and common exposures across institutions	Important	Irrelevant
Calibration	Top-down	Bottom-up

Source: Borio, 2003

3.2 Why does a micro-prudential policy fail to deal with interconnected financial system?

In the past, one could say that the safe and sound of individual institutions could safeguard the overall prospect of the financial stability condition. However, recently financial system has become more systemic. Simply put, it has become more interconnected among one another, which makes it impossible to focus only on any particular institution and to ignore the impact from the rest.

A micro-prudential policy fails to address two specific risks arising from new financial environment – pro-cyclicality and interconnectedness. The micro-prudential policy is pro-cyclical in nature, which helps amplifying business cycles. For instance, a provision for bad debt policy would require an individual institution to build-up buffer against bad debt. During a business boom, some risky loans could appear less risky allowing financial institutions to keep a portion of provision and to lend out more. Whereas the exact type of loans could appear very risky in the bust cycle causing banks to raise provision and to reduce lending, creating a credit crunch. Consequently, there is a build-up of imbalances during an upswing phase of business cycle making the financial system becomes more vulnerable to various potential shocks. In addition, a micro-prudential approach becomes more reliance on market prices in asset valuation and risk assessment. Although the use of market price to assess risk is considered

prudence such as Value at Risk (VaR)¹, the model is positively correlated with financial markets. Hence, the model encourages firms to increase their risk appetite during the business boom and to sell assets in the bust. Thus, the value of investments or portfolios of financial institutions volatiles expose the firms to the business cycle.

With regards to interconnectedness, micro-prudential policy ignores the risk transmission from one institution to another. With emphasis on the mark-to-market approach, each financial institution becomes more homogeneous.² The market price assessment shaped financial institutions' behavior including the mark-to-market valuations of asset and regulator-approved market-based measures of risk, such as the use of credit spreads in the internal credit model. The extensive use of identical risk assessment tool to make financial institutions safer promotes similar risk strategies, which results in similar 'rational' decision across different financial institutions.³ Hence, they tend to invest in similar assets, and have similar 'diversified' portfolio. This collective behavior increases interconnected among financial institutions and undermines the financial stability. These linkages expose all financial firms to a risk of solvency or liquidity event in any one institution.

The stability of each individual institution is important. Nonetheless, supervisors should not ignore the interconnectedness among financial institutions. Therefore, supervisors should apply a macro-prudential approach as a supplement to a micro-prudential one.

3.3 What is a macro-prudential policy?

The word "macro-prudential" is not a new terminology for supervisor. In fact, it was first used in the 1970s in an unpublished document of the Cooke Committee⁴ (the precursor of the Basel Committee on Banking Supervision). But the practice of macro-prudential is muted until the speech delivered by Andrew Crocket in 2000.⁵ Several countries started implementing macro-prudential measures to tackle excessive growth in real estate loan, though remained within smaller group. The recent crisis brought more attention to the notion of macro-prudential policies towards regulators and supervisors in advanced economies. Although macro-

¹ International Monetary Fund. 2007. "Do Market Risk Management Techniques Amplify Systemic Risk?" *Global Financial Stability Report*. October.

² The Warwick Commission. 2009

³ León, et al. 2011.

⁴ Clement, 2010.0

⁵ Crocket, 2000.

prudential's aim is to stabilize the financial system as a whole, the definition of macro-prudential itself is still inconclusive.

Some define a macro-prudential policy as a measure to enhance financial systemic stability by focusing on size, interconnectedness, systematically important institutions (SIFIs). In this paper, we adopted the definition from *FSB, IMF, and BIS (2011)*⁶ as it provided a much more complete picture. Macro-prudential as defined by *FSB, IMF, and BIS (2011)*

"... a 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 can have serious consequences for the real economy"

Hence, any measures aiming to limit systemic risk or system-wide financial risk are considered macro-prudential policies. These measures would try to (i) dampen the build-up of financial imbalances; (ii) build a defense mechanism against a sharp fall in the value of financial asset; and (iii) identify and address common exposures, linkages and interdependencies, which could jeopardize the financial system.⁷ These policies seek to address two weaknesses of the micro-prudential, which are pro-cyclical in nature and interconnectedness.

3.4 Coordination between monetary policies and macro-prudential policies

To design an effective framework for macro-prudential policies, authorities need to understand how the macro-prudential policies interact with monetary policies as both policies target macroeconomic stability and affect real economic variables. This interaction depends on an extent on how financial imbalances play a role in the monetary policies.

Before the crisis, many believe that monetary policies should be used to tackle inflation only; however, after the crisis, some start to reconsider using monetary policies to counter the accumulation of financial imbalances⁸. In 2010, Bernanke, in his speech, stated that under exceptional circumstances monetary policies should go beyond targeting economic stability.

Can monetary policies help stabilizing financial system?

There are four channels in which monetary policies can tackle the bubble by affecting risk taking of banks (Altunbas et al, 2010). First of all, a reduction in policies rate will boost asset

⁶ Financial Stability Board, International Monetary Fund, and Bank for International Settlements, 2011. "Macroprudential Tools and Frameworks." Update to G20 Finance Ministers and Central Bank Governors. February 14.

⁷ Monetary and Capital Markets Department. 2011. "Macroprudential Policies: An Organizing Framework."

⁸ See Bernanke, Ben. 2010

and collateral value, lower the estimate of default rate, lower the cost of funding and strengthen banks' balance sheet. Second, lower interest rate may lower return from investment, hence bank may start searching for better yields by taking on more risks. Third, lower rate may affect risk perception. An easing of monetary policies would reduce the degree of risk aversion of investors as their incomes increase relative to the norm, thereby will increase real economic activity. Last, risk-taking may be influenced by the communication of the central bank. Central bank' credibility could help reduce market uncertainty, which may encourage banks to take on more risks. Investors might be willing to take on more risky investment if they expect the central bank to lower interest rates given weakening growth prospects.

The discussion above highlights how monetary policy tools can support a macro-prudential policy by affecting banks' risk-taking behavior. But after all, using interest rates is not an ideal way to deal with excess leverage and excessive risk taking, and may also have a broader impact on the overall economy⁹. For example, raising interest rates to tackle an asset price bubble could result in undesirable consequences such as a widening output gap. Tightening monetary policy while the financial sector is still vulnerable could also lead to a systemic crisis or even an economic recession. In addition, monetary policy transmission takes some time. An interest rate hike could end up being too small for the economy or even too late. Agur et al (2009¹⁰) found that if monetary policy is used to stabilize the financial system, the policy rate would likely follow a v-shaped pattern. During downturns, a central bank would cut policy rates more deeply but for a period shorter than prescribed by a Taylor rule. This is necessary to discourage banks from taking excessive risk when interest rates remain low for an extended period of time.

Although monetary policies could help stabilize the financial system, these policies may sometimes create undesirable consequences¹¹. Hence, macro-prudential policies could fill in these gaps. For instance, if a bubble in the real estate sector is detected, an authority can impose a lower loan-to-value ratio on mortgage lending. Preserving financial stability is too big a burden to rest on any policy exclusively.

⁹ Blanchard, et al 2010.

¹⁰ Agur et al 2009.

¹¹ Jocknick, 2010.

Are there trade-offs between macro-prudential and monetary policy?

There is, however, a concern that there might be times that monetary and macro-prudential policies are in conflict, as both policies have an impact on macroeconomic variables. For instance, more stringent mortgage loans in early 1990s may have slowed the economic recovery from the recession¹². The occurrence of the conflicts depends on the type and diffusion of supply and demand imbalances across the financial system and the real economy¹³ (Table 2). A conflict would arise when an asset bubble has been identified (high credit growth) but risks to price stability are low (low inflation). In this case, demand and supply are misaligned in both the financial system and real economy in an opposite direction. Monetary policy would want to lower interest rates to stimulate economic activity and fuel more credit growth. At the same time, financial stability policy would want to implement additional macro-prudential measures to slow down credit growth, but this would inevitably weigh on economic activity.

However, Caurana (2011) stated that such conflicts are likely to be rare. He also added that in most circumstances, these two policies will complement each other or work in the same direction. For instance, in a situation where an economy experiences high inflation and excessive credit growth, an authority or a central bank can choose either to impose a strict macro-prudential policy to slow down credit growth or to increase interest rates to lower inflation pressure. If the authority decides to impose a strict macro-prudential policy, the central bank might choose not to do anything. Hence, in this situation, the central bank does not have to raise interest rates. Furthermore, in a situation where interest rates stay low for quite some time given low inflation pressure, an authority may choose to introduce a strict macro-prudential measure for fear that financial imbalances might build up. Since these two policies tend to complement each other in some situations, but may also be in conflict in some other situations, relevant authorities will need to coordinate to ensure that both policies are not in conflict with each other.

¹² Yellen, et al, 2010

¹³ Beau, et al. 2011.

Table 2: Interactions between macro-prudential and monetary policy

High inflation	Policy rate ↑↑	Policy rate ↑↑
Price stability	Macro-prudential tools ↓↓	Macro-prudential tools ↑↑
Low inflation	Policy rate ↓↓	Policy rate ↓↓
	Macro-prudential tools ↓↓	Macro-prudential tools ↑↑
	Low	High
	Financial Stability	
	Low	High
	Credit Growth	

Source:

Institutional setup

For effectiveness of a macro-prudential policy, institutional setups need to ensure coordination among policy makers. Institutional frameworks need to facilitate information flows and also secure political support. Following the recent crises, several countries started to review their institutional setups to support a macro-prudential policy mandate. Should the macro-prudential policy mandate rest with central bank, treasury, or independent institutions?

In practice, institutional setups in many countries differ in a number of ways. Nier et al (2011) has summarized stylized facts of each type of setup and assessed strengths and weaknesses of each type. Five key dimensions are identified as follows:

1. Degree of institutional integration of central bank and financial regulatory functions.

Institutional integration affects the degree of coordination between the central bank and other financial supervisors. This dimension affects how much information is available to each financial supervisor. The degree of integration can be: (i) fully integrated, where all financial supervisory and regulatory functions are performed by the central bank or its subsidiaries; (ii) partially integrated, which means that the securities supervisor or business conduct supervisor are separate entities, while prudential supervision of banks (and other institutions) is performed by the central bank; or (iii) nonexistent at all.

2. Ownership of macro-prudential policies

Ownership indicates which institutions should be accountable for limiting systemic risks. Ownership of the macro-prudential mandate can rest with the central bank or a committee related to the central bank, or an independent policy-making committee. A committee related to the central bank is legally part of the central bank, and is chaired by its governor.

3. Role of the treasury

Roles of the treasury can be: (i) active if it plays a leading role in the committee; (ii) passive if the treasury participates in the committee, but without any special role; or (iii) nonexistent at all.

4. Institutional separation of policy decisions from control over policy instruments

This dimension arises only when policymakers and policies implementation are in different institutions. Separation is common when there is no or only partial integration of supervisory function within the central bank.

5. Existence of a separate body coordinating across policies to address systemic risks.

A separate coordinating committee is a feature of some models where a policy mandate is shared among several agencies. This is not needed if the mandate and decision-making powers are entrusted to a single body.

From the five dimensions outlined above, three broad groups of institutional setups can be identified based on the degree of institutional integration between the central bank and regulatory agencies. Models for each of these three groups - full integration, partial integration and separation – are summarized in Table 3.

Full Integration Model

In this model, all financial regulatory and supervisory functions are integrated within the central bank. The central bank is the owner of macro-prudential policies, and its board becomes the decision maker of macro-prudential policies. The main advantage of this model includes cooperation in risk assessment and a proper flow of information, even confidential one. Furthermore, with its existing roles in monetary policies, in the payment system, and as the lender of last resort, the central bank can make informed deliberations on macro-prudential policies. Lastly, with the full integration model, the central bank has control over most of the

relevant tools and can ensure coherence in communications and warning messages given to the public.

However, the full integration model may lack mechanisms to challenge the views formed within a single organization. This issue becomes severe if there is no mechanism to encourage debating contrarian views. This model also implies a large and multi-functional organization, which is difficult to manage effectively.

Although this model ensures coordination in terms of risk assessment and information flow, there is no accurate instrument to detect a forming bubble, and failed prudential policies will likely hurt central bank's credibility. Moreover, there is no role for the treasury in this model. Willingness to cooperate may diminish when the treasury is excluded from discussion regarding the buildup of systemic risks and required policy actions.

Table 3: Stylized Models for Macro-prudential Policies

Features of the model	Full Integration	Partial Integration	Separation
1. Degree of institutional integration of central bank and supervisory agencies	Full (at the Central bank)	Partial	No
2. Ownership of macroprudential policy mandate	Central bank	(i) Committee "related" to central bank (ii) Independent committee (iii) Central bank	Multiple agencies
3. Role of MOF/ treasury/government.	No (Active*)	Passive	Passive
4. Separation of policy decisions and control over instruments	No (Active*)	In some areas	No
5. Existence of separate body coordinating across policies	No (Active*)	No	Yes
Examples of specific model countries/ regions	Czech Republic Ireland, Singapore*	Malaysia, Romania, Thailand, U.K., U.S.A.	Australia

* denote some real-life models are hybrids or differ from the assigned model in some respects

Source: Nier et al, 2011

Partial Integration Model

This model involves a close institutional integration between the central bank and the prudential supervisor and regulator of potentially systemic financial institutions, while the regulation of retail and wholesale financial markets is institutionally separate from the central bank. This model can be classified into three groups based on the ownership of macro-prudential policy mandate. The mandate can be entrusted to a committee related to the central bank, an independent committee, or the central bank itself. After the recent crisis, macro-prudential policies in both the UK and the US were implemented following this type of institutional setup. Under this model, the central bank still plays a prominent role in minimizing systemic risks. However, potential downsides include inadequate engagement and support from regulators outside the central bank. Access to information on securities market activity might be difficult.

If the mandate is rested with a committee related to the central bank, the responsibility of risk mitigation is still under the central bank. An example of countries adopting the model is UK. In the UK, a Financial Policies Committee (FPC) who is responsible for macro-prudential regulation is a subsidiary of Bank of England and is chaired by the governor, and Financial Conduct Authority (FCA), an independent organization, will regulate the financial institutions servicing retail consumers and in wholesale. This model inherits a number of key strengths and weaknesses from the full integration model, and thus similar to some extent. In the partial integration model, the central bank retains strong access to relevant prudential data and expertise, which are helpful in identifying risks. Furthermore, the separation between the committee responsible for macro-prudential policies and the one for monetary policies help limit reputation risks. This model also provides an opportunity for the treasury to participate without undermining the independence in the conduct of monetary policy. However, the multiagency setup might provide a sub-optimal policy mix.

If the mandate is rested with an independent committee, overall responsibility for financial stability shifts away from the central bank to the committee, in which the central bank is one of the participating members. In this model, the treasury tends to play a stronger role in decision making. One advantage of a strong role of the treasury is that the treasury can help garner political support; however, a strong role of the treasury may pose a risk that the operational autonomy of related policy fields may be undermined.

If the mandate is rested with the central bank, this model is identical to full integration in almost all aspects, except that an authority overseeing institutions servicing retail and wholesale

financial market is separate from the central bank. This model inherits a number of key strengths and potential weaknesses similar to the full integration model.

Separation Model

This model is characterized by a much larger degree of institutional separation between the central bank and supervisory agencies outside the central bank. One common feature of this model is that identification and mitigation of risks is a multi-agency effort. Although the central bank often plays a leading role in identifying and mitigating systemic risks, each individual agency decides on the use of tools under its jurisdiction. The advantage is that each individual agency can focus on their objectives to support the stability of the financial system. However, when multiple agencies are involved in risk assessment, the decision might not be optimal since no single institution has all information needed to analyze all interlinked aspects of systemic risks. Furthermore, a collective responsibility can dilute accountability and incentives. The key ingredient to success is an effective communication channel among agencies.

In summary, since there is no “one size fits all” solution, authorities need to take into account all country-specific conditions such as economic and social environment, legal system, the nature of financial system and political system to design an effective macro-prudential policy committee. Each model has its own weaknesses and strengths, and these weaknesses can be addressed by introducing appropriate incentives or compensation schemes. These include, for example, strong transparency and accountability arrangements to ensure that the committee implements the right policies at the right time. Whatever the structure of institutional setup is, the ultimate goal should be to ensure financial stability as well as macroeconomic stability.

Section 4: Crisis management

One lesson from this crisis is that an authority needs to step in fast enough to contain crisis by preventing the occurrence of the second-round effects, so that the cost of crisis would not be huge. In addition, as the financial system becomes more systemic, one bank's failure can spread out quickly, and this requires prompt collective actions to calm the marketplace and raise public confidence. Moreover, no matter how cautious the central bank or supervisors are in monitoring and supervising financial institutions, the crisis may take place at any time. Hence, authorities should stand ready to deal with the crisis by setting up a framework to deal with the crisis. Although many countries have introduced resolution policies, these policies are slow because authorities have to wait for failed banks to announce bankruptcy first, which is often too late to contain financial distress. In fact, authorities could start imposing crisis management policies much earlier, perhaps at the very first signs of troubles. Well-defined early intervention policies prior to insolvency could minimize the cost of crisis by restoring public confidence and curtailing the likelihood of bank runs. Early intervention measures should be institutionalized before the crisis takes place, as decision making takes time and may be difficult given ongoing changes in the economic and financial landscape. The early intervention policies should clearly define responsibilities. For instance, the policies should spell out who should pull a trigger for the crisis management resolution can take place. However, two issues regarding crisis management policies need to be addressed.

4.1 Who should make decision for implementing an early intervention policy?

Appropriate crisis management process is vital in containing crisis and minimizing the cost of the crisis. Since a crisis could happen no matter how hard the central banks supervise financial institutions, authorities should be ready to handle the crisis as soon as there are signs of trouble. Early intervention could protect depositors, avoid disruptive bank runs, allow the continuation of borrower-lender relationships, prevent disruption to the economy, and avoid any disruption of the payment and clearing systems. The issue is that who should be the one to make the first move and inform everyone. The authorities who can make decision should have the following characteristics:

1. Access to information

The best way to protect taxpayer is to act before the value of troubled financial institutions fell to zero or has negative worth. However, the hard part is identifying the right time to pull the trigger. Therefore, the authorities should be able to quickly and accurately estimate the value of the troubled firms especially when the market is not functioning. If the authorities pull the trigger too late, the cost of bailout will be very expensive. And if the authorities wrongly pull the trigger, the authorities may lose credibility and may result in self-fulfilling crisis. Furthermore, the authorities should be able to analyze how the crisis will proceed, namely, which institutions will be hit next. Hence, authorities need to have necessary, accurate and up-to-date information on hand in order to make accurate decision and find measure to address the problem.

2. Authority

Strong legal protection for authorities who pull the trigger is a must. The risk of legal retaliation from troubled bank's shareholders may make authorities reluctant to pull a trigger. Pulling the trigger will activate an early intervention policy. Some of the measures from this scheme may make shareholders and creditors unhappy such as the suspense of the dividend payment or management fees or write off shareholders' equity. Hence, authorities should have legal powers to implement those measures.

3. Financial resources

Once the decision is made, authorities may, sometimes, need to provide liquidity to the troubled bank while the bank management team is searching for solution or during the restructuring process in order to ensure the continuing operation of the bank. The liquidity injection is just to calm the public panic as well as eliminate the probability of bank run.

4. Prompt response

One of the goals of early intervention policy is to act promptly to reduce the cost of banking crisis. For instance, authorities should quickly introduced measures to restructure the troubled banks before the banks' net worth become negative. If the situation deteriorates, the troubled institutions should be closed quickly in an ordinary fashion if their capital declines to a low level but still greater than zero.

Does it have to be a central bank?

The answer would be no, as any authorities that have the above characteristics should be able to make a call. In many cases, this responsibility is assigned to the central bank, or to supervisory agencies depending on the institutional setup.

Central banks can be the one who can pull the trigger as it has access to information and can envisage how the crisis will proceed. The interbank market transaction provides the central bank with information regarding to interconnectedness among financial institutions. The central bank is in a position to consider macroeconomic factors that may influence or be influenced by the disturbances of shocks. Furthermore, as a lender-of-last-resort, the central bank can inject liquidity to troubled banks during a crisis. Besides, central bank can implement certain policy in a short notice.

Some countries assign supervisor agent or deposit insurance agencies to pull the trigger if they are empowered to do so. For instance, in the US, Fed is authorized to pull a trigger for banks and systemic significant financial institutions when there are signs of trouble. In Canada, Office of the Superintendent of Financial Institutions Canada (OSFI), a sole regulator of banks and primary regulator of insurance companies, trust companies, loan companies and pension fund, will be the one who make decision. OSFI will categorize an institution as troubled when the combination of overall net risk and capital and earnings compromises its resilience. In the UK, Financial Services Authority (FSA), an independent body that regulates the financial services industry in the UK is now authorized to pull special resolution regime when both of the following general conditions have been satisfied: i) the bank is likely to fail to satisfy the threshold conditions; and ii) it is not likely that any action or plan taken by financial institutions will enable the bank to satisfy the threshold condition.

4.2 Comparing financial system with a public good

What are the characteristic of a public good?

A public good or a collective good, refers to a good that is consumed by an individual will not reduce the consumption of other individuals. Simply put, a public good is defined as having two important characteristics: (i) non-rival in consumption and (ii) non-excludability.

Nonrival in consumption means that a given quantity of a public good can be enjoyed by more than one consumer without decreasing the amounts enjoyed by rival consumers. For instance, a large number of viewers can enjoy the television broadcast. The benefit of national

defense services of nonrival. When the number of residents increases, no resident suffers a reduction in the quantity of national defense.

Non-excludability means that it is too costly to develop a means of excluding individuals who refuse to pay for the benefits they receive. For instance, the national defense and clean-streets are provided for every individual, and everyone benefits from them regardless of who pays for it.

Any good that lag the above characteristics is not a public good as it is possible to exclude someone from consuming or when it is used by one individual, it will not be available to other. A club good refers to a good that is nonrival in consumption but can exclude someone from consuming. For instance, a cable television company can choose to provide service to those who pay monthly fee. Furthermore, some goods can have characteristics of rivalous and non-excludability or simply put, a good when consumed by many people at the same time will reduce the benefits to existing consumers. For instance, additional user of a congested road decreases the benefits to existing users by slowing down traffic and increasing the risk of road accident. Hence, for a good to be called a pure public good, it needs to have the above stated characteristics.

Table 4: Classification of Goods

	Excludable	Non-excludable
Rival	Pure private good (cars, telephone)	Common-pool goods (fish stocks, road)
Nonrival	Club goods (Less congested toll way, pay television)	A public good (national defense, public television)

Source: authors' classification

Besides the above two characteristics, a pure public good can generate either positive or negative externalities to all individuals. Externalities occur when individual's actions affect other individuals' well-being and the relevant costs and benefits are not reflected in market prices. For instance, when a national defense policy makes a country safe and sound from foreign threats, this will induce more investment and innovation, leading to more economic growth.

Lastly characteristic of public good is zero marginal cost. Once a pure public good is provided, the additional resource cost of another person consuming the good is zero. For

instance, a television program once aired can be viewed by thousands of people without additional cost to produce.

How should we finance a public good?

A good with these characteristics will usually be undersupplied by the private sector, as those characteristics make it difficult for the private sector to produce them profitably. For instance, non-excludable characteristic of public good creates free-rider problem as individuals have no incentive to pay for the benefits they receive when it is difficult to keep them from consuming the goods once it has been produced. As a result, a profit maximizing company would not want to produce a public good; therefore, government should intervene to make sure that it is supplied in an appropriate quantity. The government can provide a public good by taxing general public, printing money, taxing on users or taxing on producers. Whatever the choice government chooses, taxpayers will be the one who bear the cost. Hence the best choice would be to minimize taxpayer burden which depends on each country's institutional setup.

Tax on general public: the government can choose to raise income tax to finance a public good. No person enjoys paying taxes even though tax will finance government spending on producing goods that, in turn, benefit taxpayer. Using government budget ensures the transparency of using public funds to finance public goods. Nevertheless, rising tax rate would reduce the consumption of the individual as their disposable income declines with the rising tax rate. If the rate hike is too much, there will be fewer labour supplies as they would choose to enjoy leisure time.

Printing money: when the central banks print money to support government-supplied goods and services. Although people feel that they do not have to pay tax, but they are indirectly affected through higher prices or inflation. Rising inflation rate reduces real income, forcing them to reduce their consumption. Inflation will increase the degree of income inequality where the rich get richer and the poor get poorer. Lastly, printing money will conflict with monetary policy goal which is price stability, and will hurt the economy. For instance, Argentina, once known as an economic miracle with fast economic growth, became one of the world's most economic trouble spots as a result of hyperinflation. Central bank monetized government spending by printed money, causing hyperinflation in 1989 with a peak at 3000%¹⁴.

¹⁴ Fudge, 2010.

Tax on users: a special tax that charges on consumers who purchase goods that create negative externality. By doing so, consumers will choose to purchase products that are not taxed so at the same time discourage firm to produce products with negative externality. However, the tax may prevent the poor from using the products.

Tax on producers: a special tax that charge on firms who produce negative externalities. For instance emission taxes on factories that generate air pollution. This type of tax would encourage firms to upgrade their production to use better technology that will generate less air pollution. However, the tax will increase the cost of producing goods and if the firms choose to pass on the cost to customers by raising selling price, customers will have to pay higher price and low income people might not be able to afford it. Lastly, the firms may loss competitive advantage to complete with foreign competitors who can produce goods at cheaper price.

Table 5: Pros and Cons of each Type of Tax

Tax party	Pros	Cons
General public	<ul style="list-style-type: none"> ● Reduce free rider problem 	<ul style="list-style-type: none"> ● Overburden over the long run
User	<ul style="list-style-type: none"> ● Chose to buy goods that are not tax 	<ul style="list-style-type: none"> ● Expensive good ● The poor cannot afford
Producer	<ul style="list-style-type: none"> ● Reduce moral hazard problem 	<ul style="list-style-type: none"> ● Expensive good ● Loss competitive advantage ● The poor cannot afford
Central bank	<ul style="list-style-type: none"> ● Off budget 	<ul style="list-style-type: none"> ● Inflation ● Conflict with main objective

Is financial stability a public good?

Financial stability is considered a public good as it has the above characteristics. Once government implement policies to ensure financial stability everyone can enjoy the benefits regardless of whether an individual pay for the benefits or not. And the benefits of the financial stability will not be disappeared when an individual enjoy the benefit. Besides, a public good can be viewed as a special kind of externality. The absence of financial stability such as excessive volatility creates negative externality and spillovers that affect individual indiscriminately. The collapse of financial firms impose direct cost on shareholders who loses

their investments, on employees who lose their jobs, depositors who lose unsecured portion of deposit, general public may lose their jobs when an economy is in recession, and especially the poor who earn less social welfare due to cutting social welfare spending. This type of externality is nonpecuniary as it cannot be priced by the markets. Usually, normal volatility is priced through higher risk premiums or higher required returns and does not require public intervention. However, market cannot appropriately price “excessive” volatility”, and as a result, financial stability is undersupplied. Last, once the financial system is stable, ten or hundred people can enjoy the benefit at the same time without extra cost to producers. Beck et al (2010) state that since financial stability is a public good, no individual bank has strong incentives to preserve it as each one free-rides on the collective reputation of a sound and safe banking industry. Since financial stability is a public good like national defense, government should be the one who supply it, including any cost related to preserving financial stabilities such as bailout expenses. Like national defense, Ministry of Defense should not pay for the tank or helicopter if they were destroyed by the enemies during the war.

Table 6: Comparison between public goods and financial stability

	A public good	Financial stability
Non-rival	√	√
Non-excludability	√	√
Externality	√	√
Zero marginal cost	√	√

Source:

4.3 How does the deviation from traditional (Bagehot) affect the central bank?

In order to reduce moral hazard, many central banks follow principles of Bagehot by lending freely at penalty rate, with good collateral, for short time when injecting liquidity to the financial system to preserve financial stability. However, in the recent crisis, many central banks deviate from this principle by lending at discount rate, with low quality of collateral, and for a longer time.

The Classical Concept of the Lender of Last Resort

The notion of the lender of last resort (LOLR) was originated by Sir Francis Baring (1797), who referred to the Bank of England as the dernier resort for providing liquidity to the other British banks in times of crisis. However, it was Henry Thornton who specified the primary function of the LOLR. He was also the first one who pointed out the so-called moral hazard problem facing the LOLR.

Thornton (1802) identified three different characteristics of the LOLR. First of all, the LOLR has a unique position as an ultimate source of liquidity for financial system. In other words, it has sufficient liquidity in order to satisfy demand in times of stress. Second, the LOLR has the responsibilities as guardian of the central bank gold reserve. Therefore, the LOLR must hold adequate reserves to show its prompt availability in times of crisis. Third, the LOLR has public responsibilities. Unlike commercial banks that are mainly responsible for their stockholders, the LOLR's duty is to protect the whole economy.

After Thornton, it was Walter Bagehot who gave LOLR theory its strongest explication. As stated by Frank Fetter (1978), "Bagehot may not have said more than Francis Baring and Henry Thornton had said over sixty years before, but he said it in a way that carried conviction to a wider audience and to a new generation who no longer accepted all the premises which Thornton's and Baring's conclusions had sprung" (Fetter, 1978). According to Bagehot (1873) in Lombard Street, in a panic situation the LOLR should lend freely but at a penalty rate against good collateral to illiquid but solvent institutions.

Humphrey (1989) concluded the LOLR's principles from both Henry Thornton (1802) and Walter Bagehot (1873) as follows: (1) to protect the aggregate money stock, (2) to support the entire financial system, not individual institutions, (3) to behave consistently with the longer-run target of stable money growth, (4) to let insolvent institutions fail (5) to lend to sound institutions only, (4) to charge penalty rates, (5) to require sound collateral and, (6) to state policy in advance of any crisis so as to remove uncertainty.

The classical concept of LOLR aims to minimize moral hazard problem, remove banks' incentives to take risky activities and also protect central banks' balance sheet from any action they take as the LOLR.

Unconventional measure

Traditionally, the central bank usually follows the Bagehot's principle when providing liquidity injection to troubled institutions such as lend at penalty rate to illiquid but solvent financial institutions with sound collateral. The traditional LOLR practice work well to deal with simple liquidity shortage like end of the day liquidity shortage. Nevertheless, the traditional LOLR seems to be relatively inefficient to deal with recent crises like systemic shortage of funding and market liquidity. Cecchetti and Disyatat (2010) stated this type of shortage is potentially the most destructive. It involves loss of confidence and coordination failure among market participants that lead to a breakdown of key financial markets, leading to markets "runs". After the bankruptcy of Lehman Brothers in September 2009, there is a sudden and prolonged evaporation of both funding and market liquidity, with serious consequences for the stability of both the financial system and the real economy. Therefore, the traditionally LOLR requires modification. The first modification of LOLR is to make LOLR more flexible, and when the crisis intensifies the central banks introduced more aggressive unconventional measures that is similar to quasi-fiscal.

With more systemic financial system, traditional LOLR tools prove to be relatively ineffective to deal with the recent crisis (Folkerson, 2011). The crisis has spread out to many types of financial institutions including investment banks, money market mutual funds, and insurance companies. Lack of confidence in the financial market results in liquidity shortage and higher funding cost or spread. To address this problem, many central banks introduce many unconventional policy tools. For instance, the central banks have expanded the size of loan, increase frequency of operation – conducting them outside their regular schedules and in larger than usual amounts. Furthermore, many lending facilities have been introduced to allow non-depository institutions to borrow. Lastly, many central banks also expand the list of assets eligible as collateral from investment grade to more risky one. The main objective of these modifications is to contain deviations of market rates from the policy rate.

Table 7: Comparison between traditional LOLR and unconventional LOLR

	Traditional LOLR	Unconventional LOLR
Interest rate charge	Penalty rate	Discount rate
Collateral	Investment graded	More risky
(In)Solvent	Solvent	Both solvent and insolvent
Maturity	Short term	Longer term

Source:

Despite large scale intervention, the crisis continues to deepen, especially right after the collapse of Lehman Brothers. There is confidence crisis in the interbank system. Financial institutions are reluctant to lend one another due to uncertain about the financial strength of the counterparties. Furthermore, assets that once thought to be easily converted into cash are not any more. As a result, many financial institutions experience funding liquidity problem and results in loan freeze problem. Loan freeze occurs when banks fail to perform intermediation role. Loan freeze is costly to economic activities as firms could not roll over their working capital for day-to-day transactions or have to abandon worthwhile projects. Loan freeze is a result of the decline in the value of collateral assets or capital of the banks that force bank to tighten lending standard or reduce lending activities. Threatened by the loan freeze problem, the central banks quickly replace the intermediation functions of the banking system. For instance, the scope of LOLR policy implemented by the central bank becomes much broader and more aggressive, and similar to quasi-fiscal policies. The central banks intervene in the specific market segments to reduce liquidity premium on various asset classes and boost the flow of credit. For instance, the credit easing or the outright purchases of privately issued securities in an impaired credit market. The goals are to i) improve market liquidity in the impaired credit market; ii) reduce market interest rate; and iii) ease funding conditions for financial institutions; therefore, financial institutions expand their lending to the private sector.

Example includes the Fed operation. The Fed acquires large amounts of mortgage-backed securities (MBS) backed by the government-sponsored enterprises (GSE), Fannie Mae, Freddie Mac and Ginnie Mae, to reinvigorating the MBS market. Besides implementing credit easing, the central bank can implement quantitative easing by purchasing large-scale of

government debt to lower yield. This measure aim to i) encourage financial institutions to hold more risky securities by lowering the return on government bond; ii) stimulate consumption and investment. These measures, although aim to preserve the stability of financial system, also indirectly aim at stimulating the economy by targeting some sector like MBS, making them more or less similar to quasi-fiscal. Furthermore, these measures not only expand the balance sheet of the central bank, but also cause the central bank independent to be at risk.

Impact from unconventional measures

Several studies find that unconventional measures help reduce the stress in the market. By setting a dummy variable to zero before the announcement of the Term Auction Facility (TAF) program, and one otherwise, Wu (2010) finds that the implementation of the TAF reduce the 3-month Libor-OIS spread by around 50 basis points. Fleming et al (2010) assess the effectiveness of the Term Securities Lending Facility (TSLF) by regressing repo rates and spread on the amount of Treasuries made available through the TSLF program. They find that TSLF help reduce the spread by around 0.4 basis points on average. Del Negro et al (2010) using a DSGE model and find that in the absence of unconventional measures, the economy would experience Great Depression. In the other words, the unconventional measures prevent a major collapse in output and the risk of persistent deflation.

Although the introduction of unconventional measures is needed to contain financial crisis, avoid deflation and boost economic activities, these measures come with cost. First of all, the central bank needs to find the appropriate timing to unwind those policies in the future. If the unwind process are wrongly managed, it would hurt the economy as the unwind process includes raising interest rate and draining liquidity out of the system. If the central banks do not unwind the measures, the excess liquidity in the system will lead to high inflation rate. Furthermore, prolonged low-interest rate makes financial institutions search for better yield by encouraging excessive risk-taking behavior or encouraging the build-up of financial imbalance which make financial system vulnerable to shocks.

Second, central bank with negative capital will limit the ability to conduct monetary policy. As the cost of bailing out bank is huge, and if central bank has to bear this cost, the

balance sheet of the central bank can be weakened or become negative. This will limit the central bank's ability to achieve price stability goal through (i) central bank independence is at risk and (ii) central bank's credibility is at risk.

Central bank independence is at risk

One of the necessary conditions for the central bank to achieve price stability goal is to have independence, or have freedom in conducting monetary policy without political or governmental influence. There is ample empirical evidence that there is negative relationship between inflation and central bank independence. Countries with better central bank independence on average have a lower level of inflation rate than countries with lower central bank independence¹⁵. The central banks take more risky asset as collateral or purchase risky securities making their balance sheet prone to negative capital if those assets lose their value (Hubbard et al, 2009). In the US, to assist the financial markets in accommodating the credit needs of consumers and businesses of all sizes, Fed announced the Term Asset-Backed Securities Loan Facility (TSLF) to lend on a non-recourse basis to holders of certain AAA-rated ABS backed by newly and recently originated consumer and small business loans such as student loans, auto loans, or credit card loans. This transaction will inflict significant losses to central bank. Furthermore, the purchase of government bond during the crisis will also inflict capital loss to the central banks. Assuming that the central banks implement QE by purchasing a bunch of 10-year bonds at 2.5% interest rate. When the economy recovers, the interest rate may have risen to 5%, making the market price of the same bond drop significantly (Krugman, 2009). Park (2012) finds that the fiscal authorities' full backing of the monetary authorities' quasi-fiscal operations is a pre-condition for effective monetary policy otherwise an exit from QE could be inflationary and the central banks will unsuccessfully unwind inflated balance sheets. Therefore, the central bank may need to request capital injection from the Treasury, opening the door the Treasury intervention for various pressures on central bank to ease policy in exchange for capital injection¹⁶. For instance, the Bank of Japan started to gain greater independence in its conduct of policy when government reduced the support (Ueda, 2004)

¹⁵ See Cukierman (1992)

¹⁶ See Ueda, 2003 and Cukierman, 2006

Central bank's credibility is at risk

The central banks required a degree of financial strength to credibly commit to a given nominal policy objective (Stella 2005). The central banks with negative capital could not optimally conduct monetary policy because the central bank may be reluctant to raise interest rate when there is inflation pressure as higher interest rate will increase the cost of debt service which will worsen the negative capital. The central bank of Venezuela experienced insolvent from 1980s through the 1990s from quasi-fiscal policies and the cost of measures in containment of the banking crisis in 1994-95. After becoming insolvent, the central bank of Venezuela had to abandon the tightening policy after experiencing a surge in inflation after fiscal policy expansion¹⁷. Hence, Venezuela experienced runaway inflation with a peak of 115.2% (annual change in CPI) in September 1996.

Besides, the negative capital will hurt the central banks' credibility. Individuals may question the ability of the central bank to maintain price stability as individual regards the central bank with negative capital as poorly managed one. One way to conduct monetary policy is to curb the inflation expectation. If individuals believe that credible central bank will tackle inflation whenever there is inflationary pressure, the inflation will be under control. However, whenever individuals believe that central bank will not implement any drastic measures to curb down inflation, their inflation expectations increase.

4.4 How does the world solve the problem of financial bailout

The financial crisis require the Treasury and the central bank to provide extensive measure to support the financial sector. The measures include rapid and extensive monetary expansion and the extensive use of government-provided guarantees. As a result of these measures, the fiscal cost of financial crisis is very expensive. Many countries have started to discuss a way to raise revenue to pay for the of these measures. Although there are concerns that the tax would distort the market and hurt the bank's clients, many countries have already implemented some tax measures. Some countries proposed to collect ex post tax funding measures, some introduced ex ante tax funding measures, while some implement tax on bonus. Below are selected tax measures implemented by some G-20 countries.

¹⁷ Ueda, 2003.

Ex post funding measure

The government raise revenue by charging fee or tax on financial institutions to pay for the cost of bailout. A problem is that some financial institutions think the fee is unfair as they are not the one who cause the problem, they do not want to pay the fee. In the US, the Financial Crisis Responsibility Fee is introduced in 2010. The tax would only apply to those institutions that receive funding from the Treasury with \$50 billion or more in consolidated asset. The proceed from the fund is used to pay for the cost of Troubled Assets Relief Program (TARP). In the UK, the Treasury announced the introduction of the Bank Levy since 2011. The levy is to ensure that the banking sector makes a fair contribution, reflecting the risks they pose to the financial system and the wider economy. Furthermore, the Levy is expected to encourage banks to move away from risky funding models that threaten the stability of the financial sector. The Levy for 2010 is set at 0.075% of 50% of short-term liabilities and a half rate (0.0375%) of long-term liabilities. The Bank Levy is expected to raise at least 2.5 billion each year. The full rate would be at 0.105% in January 2013 (HRM Revenue & Customs).

Ex ante funding measure

The proceeds of the specific taxes are used for funding a reserve to be available for interventions in future crises. In 2009, Sweden introduces a "stability levy" to finance a 'stability fund. The stability levy is an annual tax of 0.036% on banks' liabilities, excluding equity capital and subordinated debt. Although the money from the fund is to finance measures implemented during the crisis, there will be procedures for ex post burden sharing. In Germany, the Parliament passes the legislation on bank restructuring and the establishment of the Restructuring Fund in 2010. The Fund is financed by the bank levy, which is collected from all banks in Germany. The size of the bank levy depends on the size of the bank and its degree of interconnectedness within the financial system. The target funding amounts is €70 billion.

Tax on bonus

The UK Government is the first who introduced a tax on bonus payment in the 2009 Pre-Budget Report. Bank and building society that pay discretionary bonus about £25,000 to its employees between 9 December 2009 and 5 April 2010 will have to pay an additional bank

payroll tax of 50% on the excess bonus over £25,000. This tax will not be deductible in computing the tax profit of the banks. The purpose of this tax is to encourage banks to consider their capital position and to make appropriate risk adjustments when settling the level of bonus payments above the threshold which is the median earning in the UK. If the bank choose to pay higher bonus that is not consistent with a prudent approach to risk, they should contribute more to the public finance when profits have been facilitated by significant taxpayer support for the banking sector as a whole (the 2009 Pre-Budget Report). Apart from the UK, France and Italy government also introduced bonus tax. While it is a one-time tax for France, it is a permanent tax for Italy.

Conclusion

Financial crisis are a recurrent phenomenon, and despite regulatory efforts they are likely to occur again. The recent crises reveal the importance of having well-structured crisis management policy. The crisis management should clearly define the responsibilities of each related agencies such as who will pull the trigger and who will finance the cost of each measure. These responsibilities need to be discussed in advance so that when the crisis arrives, each agency knows what to do. Failing to do so would increase the cost of bailout and the burden of crisis may be fall to the central bank. If the cost of crisis is bear by the central bank, the credibility of the central bank will be called into question. The ability to conduct monetary policy will be undermined

Section 5: Conclusions and Implications to the Bank of Thailand

This section offers three main challenging aspects of central banks' financial stability role and some policy implications. Looking ahead, there remain some major challenges for central banks, especially for Bank of Thailand, in three main areas: risk identification, risk mitigation, and policy issuance process.

First aspect: Risk identification

Recent financial crises have highlighted the appearance of the “too-connected-to-fail problem” as systemic linkages can arise not only from financial institutions' solvency problems but also from liquidity squeezes. Therefore, one of the central banks' main challenges is to find an appropriate approach to address interconnectedness among financial institutions.

According to International Monetary Fund (IMF)'s global financial stability report 2009, there are generally four types of methodologies to assess direct and indirect systemic linkages in financial sector. Because each approach has its own limitations, there remains a challenge for central banks to develop an appropriate method to address financial systemic linkages. The details of each approach are as follows.

Table 8: Methodologies to assess systemic linkages

Method	Description	Data
Network Approach	Tracking the reverberation of a credit event or liquidity squeeze throughout the banking system via direct linkages in the interbank market	Institutional Data
Distress Dependence Matrix	Examining pairs of institutions' probabilities of distress, taking into account a set of other institutions	Market Data
Co-risk Model	Exploiting market data to assess systemic linkages among financial institutions under extreme events	Market Data
Default Intensity Model	Measuring the probability of failures of a large fraction of financial institutions due to both direct and indirect systemic linkages	Historical Default Data

Source: Global Financial Stability Report, IMF (2009)

Another challenge in the aspect of risk identification is to identify systemically important financial institutions (SIFIs), which can be banks, insurance companies, or other financial institutions whose failure could trigger a financial crisis. According to Bank for International Settlements (BIS), SIFIs can be identified based on four main factors, size, interconnectedness, complexity, and substitutability. Nevertheless, there is no rigorous method to calculate each factor. Thus, there is still ongoing challenge for central banks to improve the effectiveness of SIFIs' identification in period ahead.

Second aspect: Risk mitigation

The second challenging aspect is risk mitigation. The key challenge in this area primarily relies on implementation of Basel III. Given financial environments in their own countries, central banks must decide whether measures can be fully or partly adopted. Furthermore, it is very important for every central bank to study the impacts of each measure before implementing. For example, according to Basel III, credit conversion factor (CCF) 100% should be applied to all off-balance sheet items. However, this requirement might cause some undesirable impacts on trade finance transactions which in nature are short term and self liquidating. Thus, applying CCF 100% might negatively affect import and export activities as a whole, especially for banks in emerging markets, including Thailand, where trade finance plays important parts in off-balance sheet items and acts as a major driver for economic growth.

Third aspect: Policy issuance

The last challenging aspect is policy issuance. Generally, there are three major policy menus for central banks, monetary policy, micro-prudential policy, and macro-prudential policy. Thus, key challenge for central banks in this aspect is how to find the right balance among these three policies, specifically between monetary policy and macro-prudential policy as both policies mainly focus on macro perspective. In particular, Bank of Thailand must develop clear procedures for coordination and flow of information between each policymaker to ensure effective implementation of policy measures without the conflict of interests.

Conclusions

The increase in complexity and connectivity among players in the financial system requires the reform of central banks' financial stability framework. As witnessed by recent financial crises, their impacts on economy become increasingly severe and costly overtime. These circumstances finally contribute to challenges for central banks' financial stability role in two main aspects, crisis prevention and crisis management.

For crisis prevention, central banks should implement macro-prudential policy complementary to micro-prudential policy and monetary policy in order to ensure stability in financial system. Therefore, key challenge for central banks in this aspect is how to find the right balance between monetary policy and macro-prudential policy as both policies mainly focus on macro perspective. For crisis management, central banks should be ready for stepping beyond their conventional roles. Additionally, systemic crises require prompt resolution process and principled burden sharing, aiming to avoid the negative impact on central banks' balance sheets which might exacerbate central banks' independence. Looking forward, there remain new challenges for financial stability role of central banks, especially Bank of Thailand, in three main areas: risk identification, risk mitigation, and policy issuance process.

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