The Role of Central Banks in Financial Stability

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Abstract
Monetary and financial stability are two sides of the same coin. Following the global financial crisis, central banks are expanding their financial stability function. With the advance of international banking, central banks need to coordinate financial stability internationally. The Financial Stability Board provides coordination at the global level, the European Systemic Risk Board at the European level, and the Financial Stability Oversight Council in the US. The analytical framework is not yet ready. Academics and policymakers are developing new financial stability models. They are also working on appropriate macro-prudential tools to correct the financial system when it is overheating.

Key words: central banks, coordination failure, financial stability, financial stability boards, financial supervision, financial system, international banking, macro-prudential tools, monetary stability, ministries of finance, price stability, supervisory authorities, systemic risk

JEL Classifications: E52, E58, F42, G01, G18, G21, G28, H41

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1. Introduction

In the run up to the 2007-2009 financial crisis, central banks were celebrating their success on price stability. With their independence from government and their strong analytical framework of inflation targeting, central bankers seemed to be masters of the universe. However, the global financial crisis proved to be a hard wake-up call for central bankers, who forgot about financial stability.

History teaches us that central banks have always had a dual role: maintaining price stability and financial stability (Goodhart, 1988). This chapter discusses the regained attention of central banks for financial stability. Financial stability departments of central banks are strengthened. Moreover, new structures are put in place to facilitate proper co-ordination between the major players: finance ministries, central banks, and financial supervisors.

At the global level, the Financial Stability Board at the Bank for International Settlements (the central bank for central banks), provides coordination between the authorities of the major countries. In the US, a Financial Stability Oversight Council under the leadership of the Treasury is established. In Europe, a European Systemic Risk Board under the leadership of the ECB is currently implemented. At the global and European level, central banks are in the driving seat for financial stability. By contrast, the Treasury is in the driving seat in the US. This may be partly due to the large amount of guarantees and funds which the US government had to provide to the financial sector during the financial crisis.

While structures are being put in place, the analytical framework for financial stability is still in the air. At the time of writing, there is no proper financial stability model that can steer the work of the central bank. Moreover, there is no agreement on appropriate macro-prudential tools to correct the financial system when it is overheating.

The structure of this chapter is as follows. Section 2 discusses the role of central banks in the broader monetary and financial framework. Section 3 examines the international dimension of financial stability. Can national central banks achieve financial stability on their own, or do they need to cooperate? Section 4 develops a framework for financial stability. Section 5 reviews the financial stability role of two major central banks: the Federal Reserve and the European Central Bank. It also discusses the new arrangements for financial stability boards in the US and Europe.
2. The broader monetary and financial framework

Traditionally, central banks have two major objectives: monetary stability and financial stability. In a sense, these objectives are two sides of the same coin. Failures or disruptions in the financial system have an impact on the real economy, with related effects on output and inflation. Likewise, monetary imbalances may lead to financial instability. The 2007-2009 financial crisis has \textit{inter alia} been fed by a prolonged period of overly expansionary monetary policy. Following the era of monetary targeting and subsequently of inflation targeting, we will need to think about a new framework for monetary policy taking adequate heed of financial stability (Mishkin, 2008; Kremers and Schoenmaker, 2009). A joint goal of monetary and financial stability is to counter unbalanced credit expansion, which may lead to pressures in the economy (inflation) and/or in asset prices (asset bubbles).

Looking at the history of central banking, the nineteenth century central banks played a major role in averting financial panics (Goodhart, 1988). At that time, the central bank’s concern for financial stability was arguably more important than monetary stability. After World War II, the Bretton Woods arrangements led to a prolonged period of stable financial markets. But prices were less stable, with bouts of high inflation (e.g. the oil price shock in the 1970s). Consequently, in modern history the central bank’s monetary role has come to the forefront. So much, that the financial stability role has been largely neglected in the run up to the 2007-2009 financial crisis. In the aftermath of the financial crisis, central banks are actively developing their financial stability role.

Before examining the financial stability role, we explore the overall framework of monetary stability, financial stability and financial supervision. Four distinct objectives can be observed for the broader monetary and financial system: monetary stability, financial stability (macro-prudential), soundness of financial institutions (micro-prudential) and orderly and well functioning markets and fair treatment of consumers (conduct of business). Kremers, Schoenmaker and Wierts (2003) and Herring and Carmassi (2008) provide a general overview of supervisory objectives and compare different supervisory structures. The main supervisory models are 1) the sectoral model with separate supervisors for banking, insurance and securities; 2) the single supervisor model with one supervisor for micro-prudential and conduct of business; and 3) the twin peaks model with separate supervisors for micro-prudential and conduct of business. This chapter focuses on the twin peaks model in order to explore the relationship between macro-prudential and micro-prudential supervision.

Tinbergen, the first winner of the Nobel prize for economics, argued that you need at least one policy instrument for each policy objective. In practice, the different policy tools and objectives are interrelated. An appropriate institutional structure should obtain the main synergies between the objectives and allow for an orderly and transparent resolution of the main conflicts. So, the challenge is to combine objectives within an

\footnote{A fifth objective of competition policy is not discussed here. While competition policy for the financial sector used to be part of the work domain of financial supervisors in several countries up to the 1990s, competition policy has been upgraded to a generic policy applying to all economic sectors, including the financial sector, and executed by the competition authorities.}
authority where the synergies dominate and to assign objectives to different authorities where the conflicts dominate. Figure 1 illustrates the policy framework for the monetary and financial system. To keep it simple, each policy has a primary impact on its direct objective and a secondary impact on the objective(s) next to it. The solid lines in figure 1 illustrate the primary impact and the dotted lines the secondary impact.

Figure 1: Policy framework

<table>
<thead>
<tr>
<th>Policy</th>
<th>Objective</th>
<th>Ultimate goal</th>
</tr>
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<tbody>
<tr>
<td>Monetary policy</td>
<td>Price stability</td>
<td>Stable economic growth</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(economic system)</td>
</tr>
<tr>
<td>Macro-prudential</td>
<td>Financial stability</td>
<td></td>
</tr>
<tr>
<td>Micro-prudential</td>
<td>Soundness of financial institutions</td>
<td>Protection of consumers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(individual institutions)</td>
</tr>
<tr>
<td>Conduct of business</td>
<td>Orderly markets and fair treatment of consumers</td>
<td></td>
</tr>
</tbody>
</table>

Discussions about supervisory structure often assume that these four policy areas can all be separated, and that instruments used to promote one objective do not undermine the other. The prevalent approach to financial stability, for example, implicitly assumes that the system as a whole can be made safe by making individual financial institutions safe. But this is wrong. As indicated below, this represents a fallacy of composition. It is more appropriate to think in terms of a hierarchy of objectives. The first two objectives, price and financial stability, are equally important and affect the economy at large. The latter two objectives, sound financial institutions and orderly markets/fair treatment, are also equally important. These are addressed at individual financial institutions and aim to protect individual consumers. The first two objectives aimed at the ‘system’ are more important than the latter two objectives aimed at ‘individuals’, for the simple reason that when the system goes down its individual components will go down as well. Moreover, the stability of the financial system is more important than the soundness of its individual components. In a market driven economy, firms – including financial firms – should be allowed to fail to contain moral hazard, unless there is a systemic threat.

The fallacy of composition (Brunnermeier et al., 2009) concerns the idea, fundamentally at the basis of Basel banking supervision so far, that to safeguard the system it suffices to safeguard the components. But in trying to make themselves safer, financial institutions can behave in a way that collectively undermines the system. Selling an asset when the price of risk increases may be a prudent response from the perspective of an individual bank. However if many banks act in this way, the asset price will collapse, forcing
financial institutions to take yet further steps to rectify the situation. The responses of the banks themselves to such pressures lead to generalized declines in asset prices, and enhanced correlations and volatility in asset markets. The micro policies can thus be destructive at the macro level.

This, in terms of Tinbergen, raises two issues. First, it is important to take into account the impact of using one area’s instrument not only on that area’s own objective, but also on the objectives of the other areas. Being cognizant of such cross-effects may lead to a choice and use of instrument that is less damaging to other areas, and thus to better overall results. Second, it may not always be possible in this way to avoid conflict of objectives. In that case it is unavoidable to define a hierarchy of objectives. In such situations, the macro-prudential concerns should clearly override the micro-prudential concerns. Figure 2 depicts the proposed hierarchy of objectives.

**Figure 2: Hierarchy of objectives**

<table>
<thead>
<tr>
<th>Level</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economy</td>
<td>Monetary stability ↔ Financial stability: macroprudential</td>
</tr>
<tr>
<td>Individual institutions</td>
<td>Financial soundness: microprudential ↔ Conduct of business</td>
</tr>
</tbody>
</table>

If conduct of business and micro-prudential can be separated in practice, no hierarchy between the two is needed and each can best be served by a separate supervisor (for sure, conduct of business ought not to be dominated by micro-prudential – a bank with a consumer-unfriendly business model should be allowed to disappear from the market). By contrast, macro-prudential cannot be separated from micro-prudential and indeed the former must be dominant, implying the need for an institutional setting where macro-prudential can drive micro-prudential.

Conduct of business can thus be seen as a separate objective with its own supervisor and its own instruments. But where does that leave us regarding the relation between

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3 Which one dominates depends on the perspective. In a single supervisor setting, separate from the central bank, the conduct of business objective may dominate (Taylor, 2009). In a single supervisor setting, within the central bank, the macro prudential objective may dominate (Kremers, Schoenmaker and Wierts, 2003). In the first setting, lawyers set the dominant culture; in the second, economists are the dominant players (Goodhart, Schoenmaker and Dasgupta, 2002).
monetary policy with price stability as its objective and the interest rate as its traditional instrument on the one hand, and macro-prudential supervision with financial stability as its objective and instruments which are highly complementary to micro-prudential instruments (capital and liquidity requirements, etc) on the other? We believe the crisis has shown that this is not simply a matter of two separate objectives each with its own separable instrument, but rather of an interrelation involving two objectives and two instruments.

This brings us into uncharted territory, where monetary policy must systematically take into account its consequences not just for price stability but also for financial stability, and macro-prudential supervision must serve not only financial stability but also help avoid bubble-induced inflation (see e.g. Brunnermeier (2010) and Soros (2010) for some early thoughts). Financial crises such as that in Asia and the recent global one have made abundantly clear that narrow monetary policy à-la-Greenspan must be replaced by a new monetary policy approach integrating macro-prudential supervision and hence relying, next to the interest rate, also on the instruments of macro- and micro-prudential supervision. In terms of the organization of supervision, this points to a need for a close relationship between the monetary authority and the macro- and micro-prudential supervisor. A broad central bank would execute all three functions of monetary policy, financial stability and financial supervision (i.e. prudential supervision).

Macro-prudential instruments are still being developed. On the capital front, one can think of an anti-cyclical capital add-on for macro-prudential reasons and a minimum capital requirement based on micro-considerations. Similarly, a liquidity risk charge to influence short-term funding is suggested by Perotti and Suarez (2010). More broadly, a quarterly or semi-annual review of the financial system can be seen as a macro-prudential instrument, publishing newly collated data relevant for fostering macro-prudential stability (e.g. on system-wide or sub-sector exposures that are deemed vulnerable).
3. Financial stability: national or international?

Can national central banks achieve financial stability on their own, or do they need to cooperate? Financial stability is a public good, as the producer cannot exclude anybody from consuming the good (non-excludable) and consumption by one person does not affect consumption by others (non-rivalness). An important question is whether governments can produce this public good at the national level in today’s globalised financial markets.

At the global level, the Financial Stability Board (FSB) is established to coordinate at the international level the work of national financial authorities (ministries of finance, central banks and supervisory agencies) and international standard setting bodies (such as Basel Committee on Banking Supervision and the International Accounting Standards Board) in order to develop and promote the implementation of effective regulatory, supervisory and other financial sector policies. In collaboration with the international financial institutions (BIS, IMF, OECD and World Bank), the FSB addresses vulnerabilities affecting financial systems in the interest of global financial stability.

The main tasks of the FSB (2009) are:

a) assess vulnerabilities affecting the global financial system and identify and review on a timely and ongoing basis the regulatory, supervisory and related actions needed to address them, and their outcomes;

b) promote coordination and information exchange among authorities responsible for financial stability;

c) monitor and advise on market developments and their implications for regulatory policy;

d) advise on and monitor best practice in meeting regulatory standards;

e) undertake joint strategic reviews of the policy development work of the international standard setting bodies to ensure their work is timely, coordinated, focused on priorities and addressing gaps;

f) set guidelines for and support the establishment of supervisory colleges;

g) support contingency planning for cross-border crisis management, particularly with respect to systemically important firms;

h) collaborate with the IMF to conduct Early Warning Exercises.

But the FSB has mainly an analytical and advisory role. The question is whether more integrated regions need a stronger form of coordination. Especially in Europe, an important challenge for maintaining financial stability arises from cross-border banking. Pan-European banks create cross-border externalities in case of (potential) failure (Schoenmaker and Oosterloo, 2005). There are at least 46 EU banking groups with significant cross-border activities, accounting for 68 percent of overall consolidated EU banking assets (Trichet, 2007). This indicates that EU banks with significant cross-border activity hold a sizable share of total EU banking assets. Cross-border banking occurs across the EU and is not confined to the euro area. Especially financial

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5 It should be noted that these figures have changed during this crisis. Nevertheless, cross-border banking is still an important element of the European banking system.
intermediaries from the UK are central players. Moreover, banks from other European countries (EU-15) own most banking assets in the new EU Member States (EU-12).

Table 1 summarizes the size of cross-border banking across the different continents. There are several indicators to measure the spread of banking activities over different countries (Sullivan, 1994). An often used indicator is the Transnationality Index (TNI), which is calculated as an unweighted average of (i) foreign assets to total assets, (ii) foreign income to total income and (iii) foreign employment to total employment. Schoenmaker and Van Laecke (2007) report the TNI for the largest 60 banks using 2005 figures.

Table 1. Geographical spread of activities for top 60 banks

<table>
<thead>
<tr>
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<th>Home country: $h$</th>
<th>Foreign countries: $f$</th>
</tr>
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<tbody>
<tr>
<td>American banks</td>
<td>78%</td>
<td>22%</td>
</tr>
<tr>
<td>Asian-Pacific banks</td>
<td>86%</td>
<td>14%</td>
</tr>
<tr>
<td>European banks</td>
<td>53%</td>
<td>47%</td>
</tr>
</tbody>
</table>

Source: Schoenmaker and Van Laecke (2007)

Table 1 indicates that American and Asian-Pacific banks are primarily domestically oriented ($h \approx 0.8$). The degree of financial integration is limited. So, national financial stability is still a viable strategy for American and Asian-Pacific countries. By contrast, the cross-border penetration of the European banks is close to 50% ($f \approx 0.5$). Table 1 suggests that the level of integration in Europe may require a coordinated approach at the European level.

The interaction of highly cross-border penetrated banking systems and national financial stability management might be a dangerously weak institutional feature in Europe. The reason is that national authorities have a mandate for maintaining financial stability in their own system and they may therefore be reluctant to help solving problems in other EU Member States. To formalize this issue, two different models of recapitalizing banks are examined: a single country and a multi-country model.

**Single country model of bailout**

Freixas (2003) presents a model of the costs and benefits of a bailout. The model considers the ex post decision whether to recapitalize or to liquidate a bank in financial distress. The choice to continue or to close the bank is a variable $x$ with values in the space $\{0, 1\}$. Moreover, $\theta$ denotes the social benefits of a recapitalization and $C$ its costs. The benefits of a recapitalization include those derived from avoiding contagion and maintaining financial stability. The direct cost of continuing the bank activity is denoted by $C_c$ and the cost of stopping its activities by $C_s$ and the difference is $C = C_c - C_s$. The case $C < 0$ is obviously possible, but is a case where continuing the bank’s operations are cheaper than closing it, so that continuation is preferred and the recapitalization decision is simplified. In this situation, private sector solutions are possible and the central bank can play the role of ‘honest broker’.

The optimal decision for the authorities will be to maximize:

$$x^* (\theta - C)$$

so that
This simple model shows that a bank will be recapitalized whenever the total benefits of an intervention are larger than the net costs. In the case of a bailout, the authorities will contribute $C$.

**Multi-country model of bailout**

In the multi-country model, Freixas (2003) considers the case where the mechanism is set in such a way that the bank is recapitalized only if a sufficient contribution from the different countries can be collected. This is an interpretation of improvised co-operation: the countries concerned meet to find out how much they are ready to contribute to the recapitalization, denoted by $t$. If the total amount they are willing to contribute is larger than the cost, the bank is recapitalized. The decision is:

$$
\begin{cases}
  x^* = 1 & \text{if } \sum_j (t_j - C_j) > 0 \\
  x^* = 0 & \text{if } \sum_j (t_j - C_j) < 0
\end{cases}
$$

and the $j$-country objective will be to maximize:

$$x^*(\theta_j - t_j)$$

This game may have a multiplicity of equilibria, and, in particular, the closure equilibrium $t_j = 0, x^* = 0$ will occur provided that for no $j$ we have:

$$\theta_j - \sum_j C_j > 0$$

that is, no individual country is ready to finance the recapitalization itself. Obviously, if this equilibrium is selected, the recapitalization policy is inefficient as banks will almost never be recapitalized.

That in most cases the closure equilibrium will occur, can be explained by the fact that part of the externalities fall outside the home country (although it is safe to assume that in the current setting the country with the highest social benefits of a recapitalization is the home country). The countries are grouped as follows: the home country denoted by $H$, all other European countries denoted by $E$, and all other countries in the world denoted by $W$. The social benefits can then be decomposed into the social benefits in the home country ($h \cdot \theta = \theta_h$), the rest of Europe ($e \cdot \theta = \theta_e$) and the rest of the world ($w \cdot \theta = \theta_w$):

$$\sum_{j=1}^W \theta_j = \theta_h + \sum_{j \in H} \theta_{e,j} + \sum_{j \in E} \theta_{w,j}$$

The term ‘improvised co-operation’ has been coined to convey the view of an efficient, although adaptive exchange of information and decision taking. It relies on the idea that maintaining financial stability is a goal that every individual country is interested in achieving, so there are good grounds for co-operation (Freixas, 2003). It can be argued that improvised co-operation corresponds to the current situation in the EU.

This assumption is consistent with the post-BCCI Directive that stipulates that banks have to be headquartered in the country where most of their business is conducted.
In this equation $h$, $e$ and $w$ are indexes for the social benefits (i.e., externalities caused by the possible failure of a financial institution) in the home country, the rest of Europe, and the rest of the world. The sum of $h$, $e$ and $w$ is 1. When the total social benefits are close (or equal) to the social benefits of the home country ($\theta$ is close to $\theta_h$, so $h$ is close to 1), the home country will be willing to bailout the financial institution. In all other cases ($h < 1$), the home country will only deal with the social benefits within its territory, while host countries expect the home country to pay for (a part of) the costs in the host country. Current national based arrangements undervalue externalities related to the cross-border business of financial institutions. As a result, insufficient capital will be contributed and the financial institution will not be bailed out.

This model pinpoints the public good dimension of collective bailouts and shows why improvised co-operation will lead to an under-provision of public goods, that is, to an insufficient level of recapitalizations. Countries have an incentive to understate their share of the problem so as to incur a smaller share of the costs. This leaves the largest country, almost always the home country, with the decision whether to shoulder the costs on its own or let the bank close, and possibly be liquidated.

The outcome of this model is consistent with the findings of Schinasi (2007). Applying the theory on ‘economics of alliances’, he examines decision-making in a group of countries. Schinasi (2007) concludes that the provision of shared financial stability public goods results in an equilibrium that is sub-optimal from a European perspective, even though each country views its own decision as optimal and has no incentive to change its resource allocation decision if other countries maintain theirs.

A case in point is the rescue operation of Fortis in October 2008. The institutional setting with national authorities was not capable to reach a collective approach for Fortis, a cross-border bank with its main operations in the Benelux countries (Schoenmaker, 2008). National authorities were responsible for crisis management. When Fortis was first recapitalized, the Belgian, Dutch and Luxembourg governments provided capital injections to the national banking parts (Fortis Bank, Fortis Bank Netherlands, and Fortis Bank Luxembourg, respectively) and not to the Fortis Group as a whole. When the first recapitalization of EUR 11 billion proved to be insufficient, Fortis was torn apart along national lines: the Dutch parts were nationalized by the Dutch government and the solvent Belgian/Luxembourg parts were sold to the French banking group BNP Paribas.

In sum, national financial stability management leads to an under-provision of recapitalization, and therefore more European based mechanisms for the management and resolution of cross-border financial crises need to be developed. This is because national authorities (central banks and ministries of Finance) only have a mandate for maintaining national financial stability and may therefore be reluctant to provide liquidity or solvency support to banks in other EU countries. They do not take cross-border externalities caused by financial institutions under their jurisdiction into account. When moving to a European mandate for financial stability (as for monetary stability), these externalities will be internalized leading to an efficient outcome.
4. Financial stability framework

In order to maintain financial stability, central banks should have a structure in place that enables them to: (i) identify potential vulnerabilities at an early stage, (ii) take precautionary measures, which make it less likely that costly financial disturbances occur, and (iii) undertake actions to reduce the costs of disturbances and restore financial stability after a period of distress. Figure 3 shows such a framework (De Haan, Oosterloo and Schoenmaker, 2009).

Assessment
Central banks need to monitor and analyze all potential sources of risks and vulnerabilities, which requires systematic monitoring of individual parts of the financial system (financial markets, intermediaries, and infrastructure), the interplay between these individual elements, as well as macroeconomic conditions. To come up with a comprehensive view of the stability of the financial system, different steps have to be taken. First, central banks assess the individual and collective robustness of the intermediaries, markets, and infrastructure that make up the financial system. There is no standard framework to analyze financial stability. In an effort to improve the quality and comparability of basic data, the IMF has developed a set of Financial Soundness Indicators (FSIs) as a key tool for macro-prudential surveillance (see IMF, 2004).

Figure 3: Framework for maintaining financial stability
Central banks need to identify the main sources of risk and vulnerability that could pose challenges for financial system stability in the future and assess the ability of the financial system to cope with a crisis, should these risks materialize. The overall assessment will make clear whether any (remedial) action is needed.

If the assessment does not suggest any immediate dangers, continued supervision, surveillance, and macroeconomic policies, are key to preserve the stability of the financial system. In addition, communicating on these issues is important. There are various ways of communicating to the public on financial stability policies. One such method is the publication of a Financial Stability Review (FSR). The purpose of publishing a FSR is to promote awareness in the financial industry and among the public of issues that are relevant for safeguarding the stability of the financial system. By providing an overview of the possible risks to and vulnerabilities of the financial system, the FSR can also play a role in preventing financial crises. In this respect, Svensson (2003, pp. 26-27) argues that publication of a FSR serves “to assure the general public and economic agents that everything is well in the financial sector when this is the case. They also serve as early warnings for the agents concerned and for the financial-regulation authorities when problems show up at the horizon. Early action can then prevent any financial instability to materialize, keeping the probability of future financial stability very low.”

The growing interest of central banks in monitoring and analyzing risks and threats to the stability of the financial system has spurred the publication of FSRs. During the last decade, the number of central banks that publish a FSR has increased rapidly from 1 in 1996 to over 40 in 2005 (see Figure 4). The Bank of England was the first to publish a FSR in 1996. The ECB and the Bank of Japan published their first FSR in 2004, respectively 2005. Until now, the Federal Reserve Board has refused to publish a FSR.
Tools for measuring system-wide risks and calibrating policy tools are far from straightforward (Borio and Drehman, 2009) and the analyses and recommendations put forward in the FSRs can be improved upon. As for the latter, Cihák (2006) argues that this includes clarifying the aims of the FSRs, providing an operational definition of financial sector soundness, clarifying the core analysis that is presented in FSRs consistently across time, making available the underlying data, discussing more openly risks and exposures in the financial system, making greater use of disaggregated data, focusing more on forward-looking measures rather than backward-looking description of indicators, and presenting stress tests that are comparable across time, and among other things include scenarios, liquidity risks, and contagion.

Preventive and remedial action
The next step in the framework of Figure 4 is taking action on the basis of the assessment (something that has clearly been lacking in the build-up of the 2007-2009 financial crisis). If there are any indications of possible financial distress, it is up to the competent authorities (central banks and supervisors) to react properly. The public authorities can take informal action through correspondence and discussion with the affected institutions(s) to solve these problems. They can also use informal pressure to influence the behavior of financial players. Generally, the public authorities might exert moral suasion in two different situations. First, when they want to influence expectations of the general public through external statements or speeches, and second, when they attempt to persuade financial intermediaries to modify their behavior in the interest of the sound development of markets. If moral suasion fails, other policy instruments, such as surveillance and supervision, need to be intensified in order to correct the situation at hand.
If financial conditions nevertheless worsen and a financial crisis occurs, one cannot pinpoint a single set of instruments that should be used. Generally, crises are never exactly alike and options differ as to which particular approach is ‘best’ for resolving them. Although there is no blueprint for crisis resolution, generally four reactive instruments can be considered:

(i) private sector solutions,
(ii) liquidity support measures,
(iii) public intervention tools, and
(iv) winding down.

Crisis management starts with the containment of liquidity pressures through liquidity support, guarantees on bank liabilities, deposit freezes, or bank holidays. This containment phase is followed by a resolution phase during which typically a broad range of measures (such as capital injections, asset purchases, and guarantees) are taken to restructure banks and reignite economic growth (Laeven and Valencia, 2010).

(i) Private sector solutions
If a financial crisis occurs, authorities often try to involve the private sector as much as possible in its resolution. Two types of private sector solutions can be distinguished:

- ad hoc mechanisms, such as liquidity provision, a merger or acquisition (capital infusion) or other rescue operations, which may be considered in case of an emergency. These solutions can be promoted by the authorities acting as honest broker, especially given the time constraints under which most crises have to be solved and the potential information asymmetries that then exist.

- predetermined mechanisms aimed at preventing spill-over effects of financial crises. An example is the German Liquidity Consortium Bank (LIKO-bank), a semi-private institution that was founded in 1974 after the failure of the Herstatt Bank in order to bridge possible liquidity shortages of individual banks that are financially sound. However, as a ‘lender of penultimate resort’ the LIKO-bank may not lend to insolvent institutions.

If a private sector solution is not immediately at hand, the public authorities can bridge the gap between failure and resolution by a third party (bridge banking).

(ii) Liquidity support measures
According to Frydl and Quintyn (2000), liquidity support from the public authorities to troubled financial institutions starts long before the systemic nature of a banking crisis has been recognized. When a bank, or several banks, start experiencing substantial withdrawals from depositors and creditors, and they cannot borrow directly (or only at high rates) in the inter-bank market, the public authorities (usually the central bank) can become their Lender of Last Resort (LOLR). In principle, central banks should only support illiquid but still solvent banks. Yet, during the early stages of an unfolding crisis, it is often very difficult to distinguish illiquidity from insolvency. Very often, it turns out that banks resorting to the central bank for liquidity support have been insolvent for a while, without this being known. In a crisis situation it is hardly possible to distinguish between illiquidity and insolvency. So, the LOLR interventions by the public authorities mostly involve high-risk loans, which eventually may lead to huge costs to the taxpayers. Apart from liquidity support to individual financial institutions, liquidity support can also be given to the market as a whole. Emergency assistance to the market is provided
temporarily to relieve market pressure following an adverse exogenous shock (for example, the 9/11 terrorist attacks and the sub-prime mortgage crisis of 2007/2008).

(iii) Public intervention tools
Once the true nature of a crisis has been identified and bank insolvency has been revealed as widespread, facilities like deposit insurance schemes may act as stabilizers to the financial system. There are two rationales for deposit insurance (MacDonald, 1996):

- consumer protection: deposit insurance protects depositors against the consequences of the failure of a bank. It is difficult for (potential) depositors to assess the financial health of banks. Only a small part of the information necessary to make an effective assessment of a bank is publicly available and, even then, the general public may have difficulties in interpreting such information.
- reducing the risk of a systemic crisis: without deposit insurance, uninformed depositors might remove their deposits from sound banks in reaction to problems at a single bank (bank run). In order to meet these withdrawals, banks have to liquidate their asset portfolio at a loss, and eventually might fail. If depositors know that their money is safe because of the insurance, they will have no reason to withdraw it. Deposit insurance can thus be seen as a preventative instrument as well. This however requires a high coverage level (e.g., 100 percent deposit guarantee) and rapid pay-out.

Although deposit insurance funds were originally aimed at preventing bank runs, in some countries these funds may also be used for restructuring of failing banks. It is, however, questionable whether this is the purpose of deposit insurance. Quite often countries have established limited deposit insurance funds. Experience has shown that limited deposit insurance schemes are inadequate to maintain or restore confidence during a (systemic) banking crisis. In order to prevent or stop bank runs countries can resort to the announcement of full protection for depositors and creditors. However, such a blanket guarantee can come at great costs (as the liability is against assets of uncertain value).

When the failure of a financial institution could create systemic problems, the government may decide to recapitalize (or even nationalize) the institution. This option is optimal if the costs of recapitalization are lower than the social benefits of preserving financial stability. Recapitalization may consist of a direct capital injection or the purchase of troubled assets. As the provision of solvency support puts taxpayers’ money at risk, the decision to recapitalize is normally taken by the government, and not by the central bank. Initially, the fiscal costs of nationalization will be relatively high, but the government can try to sell the nationalized institution at a later date. Often a so-called Banking Restructuring Agency (BRA) is established to restore the health of the banking system (see Box 1). In order to protect the BRA from political interference, Enoch et al. (2001) argue that the BRA should be functionally independent from the government and publicly accountable.

While in previous crises it took policymakers about one year from the time that liquidity support became extensive before comprehensive recapitalization measures were implemented, in the 2007-2009 crisis recapitalization measures were implemented around the same time that liquidity support became extensive (Laeven and Valencia, 2010).
Box 1 Resolving banking crises: experiences of the Nordic countries and Japan

The Nordic countries and Japan experienced severe banking crises in the 1990s. While there are many comparisons that can be made between the Nordic and Japanese banking crises, the approach that was taken to resolve these crises and the actual outcome differed considerably. While the Nordic authorities reacted promptly, the response of the Japanese authorities was slow. As a result, the Nordic banking crises were resolved relatively quickly, while the Japanese banking crisis continued for more than a decade. While the costs of the Nordic banking crises amounted to a fiscal cost of 8 percent of GDP, the Japanese authorities spent more than 20 percent of GDP on the restructuring of their banking system.

There are a number of substantial differences between the approaches pursued in the Nordic countries and in Japan. First, the Banking Restructuring Agencies formed in the Nordic countries were much more aggressive in disposing of, and restructuring, troubled loans. Klingebiel (2000) reports that the percentages of assets transferred by the asset management companies (or bank restructuring agency) in Finland and Sweden were 64 and 86 percent, respectively. In each case, the initial amount of assets transferred was about 8 percent of GDP. Both restructuring agencies accomplished their loan disposals within five years of establishment.

Second, there was a significant contrast in the willingness to shrink the banking sector. Hoshi and Kashyap (2004) show that in Finland total domestic bank assets fell by 33 percent between 1991 and 1995, while in Sweden domestic commercial bank assets dropped 11 percent between 1991 and 1993. In contrast, total domestic bank assets in Japan fell less than 1 percent between 1993 and 2003.

Third, when the downsizing and loan disposal occurred in the Nordic countries, the financial institutions were decisively recapitalized and management typically was changed. Such a firm line was absent in Japan. There was little public support for banks in Japan. This restricted the ability of the Japanese ministry of Finance to recapitalize banks (Hoshi and Kashyap, 2004).

(iv) Winding down

When systemic risks are negligible, or when the costs of intervention are higher than the potential social benefits, the authorities will opt for the winding-down of the troubled institution. However, the closure of a financial institution creates potential for disruption, especially to market functioning and liquidity. Therefore, the authorities should ensure that the winding down is managed in an orderly manner. One way to contain the negative effects is by liquidity support to other intermediaries. However, “when financial distress has been broad-based or has involved systemically important institutions, liquidation has rarely been the preferred option.” (OECD, 2002, p. 131). The expectation that large financial institutions are ‘too big to fail’ may give rise to moral hazard. Moral hazard refers to the risk that once people know there is some sort of safety net or insurance they take greater risk than they would do without this protection.
During the 2007-2009 crisis, it appeared impossible to close down the so-called systemically important financial institutions (SIFIs). To address the moral hazard of this too big to fail problem, proposals are introduced to ask SIFIs to prepare resolution plans in case they hit the regulatory insolvency trigger point (which must be substantially above zero economic net worth, book value insolvency, or illiquidity). The plan for resolution would be negotiated in advance between the SIFI’s supervisors and its management (Claessens et al., 2010). This process should include the SIFI’s board of directors and its international college of supervisors. The resolution plan should ensure that a SIFI can be dismantled without interrupting the provision of any systemically important services or creating any other major spillovers. The resolution plan will have to be reviewed annually and subjected to stress simulations by the college of supervisors. This process will make clear to the market that no firm is indispensable and that whatever essential functions a firm performs can continue to be provided. This will help to combat the increase in moral hazard resulting from the bailouts conducted by countries in the wake of the financial crisis.
5. Financial stability functions of central banks

It is interesting to contrast the financial stability functions of the two main central banks: the Federal Reserve and the ECB.

Under the Federal Reserve Act of 1913, twelve Federal Reserve Banks were established under the umbrella of the Federal Reserve Board and designated the Federal Reserve System, the Fed. The functions of the Fed included currency issue, the provision of banking services to the government, the provision of discounting and clearing facilities to member banks, and the regulation and supervision of member banks (Capie, Goodhart, Fischer and Schnadt, 1994). The Fed was also considered as lender of last resort (LOLR). The latter function is often labeled as the discount window function of the Fed: discounting bills from banks. The Fed has thus been a broad central bank from its start. It has the full set of financial stability functions, including the lender of last resort function, and the banking supervision function.

In each major reform (e.g. the Gramm-Leach-Bliley Act of 1999, the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010), the supervisory role of the Fed was intensely discussed. Both times, the role of the Fed was strengthened. The Gramm-Leach-Bliley Act enabled financial conglomerates combining banking, securities and insurance in separate entities under a (bank) holding. The Fed’s role as holding supervisor was reinforced. In the Dodd-Frank Act, the Fed’s role overseeing systemically important payment and settlement systems was reinforced.

At the time when Economic and Monetary Union (EMU) was designed in the 1990s, Folkerts-Landau and Garber (1992) published a paper titled: “The European Central Bank: A Bank or a Monetary Policy Rule?” in which they introduce two concepts of central banking. The narrow concept only includes monetary stability (monetary policy rule), while the broad concept includes monetary as well as financial stability (like the lender of last resort (LOLR) function and supervision of financial institutions). The ECB is largely modeled after the Bundesbank and follows the narrow central banking concept focusing on monetary stability. The Maastricht Treaty defines maintaining of price stability as the primary objective (art 105.1) of the European System of Central Banks (ESCB), and specifies that the ESCB should only contribute to the supervision and financial stability policies of the national authorities (art 105.5). Folkerts-Landau and Garber (1992) argue that the narrow mandate for the ECB may hamper the development of the EU financial system.

Still, the ECB is slowly moving to become a full-fledged central bank by developing its ‘banking’ functions. It has been publishing a Financial Stability Review since 2004.8

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8 A particular issue for the ECB was the appropriate level: the EU level (because of the EU Internal Market for financial services) or the euro-area level (because of the monetary responsibility for the euro currency). The ECB decided to examine the stability of the financial system at the euro-area level. Most authors agree that financial stability should be managed at the European level (see section 3), but there is no agreement on the precise scope. Some argue that financial stability is primarily a concern for the euro area (Pisani-Ferry et al., 2008), while others consider financial stability as an issue for the EU as a whole (Goodhart and Schoenmaker, 2009; Nieto and Schinasi, 2007).
Moreover, the ECB acted as LOLR throughout the recent financial crisis during which there were severe problems in the wholesale interbank market. Surplus banks became unwilling to lend to deficit banks because of concerns about their solvency due to losses on and exposures to sub-prime mortgages. The ECB was pro-active and provided short-term funds to deficit banks and absorbed funds from surplus banks. The ECB provided liquidity through its instrument of open market operations (OMO) and standing facilities (marginal lending facility and deposit facility). This is the so-called general LOLR function, under which liquidity is available for all banks against collateral in a standardized way. The ECB’s policy was successful in stabilizing the euro-area interbank market. By its generous provision of liquidity to all banks (and a broader range of eligible collateral), the ECB has come close to becoming a LOLR for ailing individual banks. However, decisions to provide emergency liquidity assistance to banks (individual LOLR) are up to the national central banks in the respective countries where banking groups are licensed and operate (Padoa-Schioppa, 1999). This national responsibility can lead to multiple coordination problems (see section 3).

During the 2007-2009 financial crisis, the ECB has established itself as an effective European crisis manager. But the ECB has no powers to prevent and manage crises in the financial system, including problems with cross-border banks.

Financial Stability Boards
The 2007-2009 financial crisis has raised the awareness of the need to ‘manage’ financial stability. While the central bank has a strong role in financial stability management, it is dependent on other players: the ministry of finance for the deep pockets to rescue financial institutions, and the supervisors for the information on individual financial institutions. The US and Europe take different routes in setting up a financial stability board. The Treasury is the central player in the new Financial Stability Oversight Council, established by the Dodd-Frank Act. The ECB is the central player in the new European Systemic Risk Board, proposed by De Larosière (2009).

(i) Financial Stability Oversight Council
The Dodd-Frank Act creates two new agencies, the Financial Stability Oversight Council (FSOC) and the Office of Financial Research (OFR), to monitor systemic risk and research the state of the economy. The two new offices are attached to the Treasury Department, with the Treasury Secretary being Chair of the Council. The FSOC has to identify threats to the financial stability of the United States, promote market discipline, and respond to emerging risks to the stability of the US financial system. At a minimum, it must meet quarterly. Specifically, there are three purposes assigned to the Council:

1. identify threats to the financial stability of the United States from both financial and non-financial organizations

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9 However, at the EU-wide level the ECB and the Bank of England (BoE) followed different policies and did not coordinate. Fearful of overreliance on central bank funds by banks (moral hazard), initially the BoE did not provide extra liquidity. Liquidity shortages in the UK interbank market caused severe funding problems for Northern Rock culminating in a bank run on retail deposits in September 2007. The BoE provided a massive lender of last resort loan to keep Northern Rock afloat and the UK government subsequently nationalised Northern Rock.
2. promote market discipline, by eliminating expectations that the Government will shield them from losses in the event of failure 
3. respond to emerging threats to the stability of the US financial system.

The Council must collate data (received from affiliated agencies, and optionally from the companies themselves) to assess risks to the financial system, monitor the financial services marketplace, make general regulatory recommendations to affiliated agencies reflecting a broader consensus, and it may also compel the Federal Reserve to assume an oversight position of certain institutions considered to pose a systemic risk. The Council must monitor domestic and international regulatory proposals and developments, and advise Congress in these areas. The Council and the associated Office of Financial Research are charged to facilitate information sharing and coordination among the member agencies and other Federal and State agencies regarding domestic financial services policy development, rule-making, examinations, reporting requirements, and enforcement actions.

The voting members of the FSOC include the Treasury (chair), the Fed, the Comptroller of the Currency, the Bureau of Consumer Financial Protection (the new financial consumer authority), the SEC, the FDIC, the CFTC, the Federal Housing Finance Agency, and the National Credit Union Administration Board. In addition, there are non-voting advisory members: the Office of Financial Research (part of the Treasury), the Federal Insurance Office (a new body at the Treasury), a state insurance commissioner, a state banking supervisor, a state securities commissioner. The membership indicates the dominant role of the Treasury. Moreover, the federal supervisors have the overhand, with some minor input from state supervisor.

The Council draws on resources of the Federal government. The Council has very broad powers to monitor, investigate and assess any risks to the US financial system. The Council has the authority to collect information from any State or Federal financial regulatory agency, and may direct the Office of Financial Research, which supports the work of the Council, "to collect information from bank holding companies and nonbank financial companies". The Council monitors domestic and international regulatory proposals, including insurance and accounting issues, and advises Congress and the Federal Reserve on ways to enhance the integrity, efficiency, competitiveness and stability of the US financial markets. On a regular basis, the Council is required to make a report to Congress describing the state of the US Financial System. Under specific circumstances, the Chairman of the Council (who is also the Secretary of the Treasury), with the concurrence of 2/3 voting members, may place non-bank financial companies or domestic subsidiaries of international banks under the supervision of the Federal Reserve if it appears that these companies could pose a threat to the financial stability of the US.

Under certain circumstances, the Council may provide for more stringent regulation of a financial activity by issuing recommendations to the primary financial regulatory agency, which the primary financial agency is obliged to implement – the Council reports to Congress on the implementation or failure to implement such recommendations.

Finally, the Office of Financial Research, a department within the Treasury, provides administrative and technical support to the Council.
European Systemic Risk Board

In October 2008 the European Commission mandated a High Level Group chaired by former managing director of the IMF Jacques de Larosière to give advice on the future of European financial regulation and supervision. The Group presented its final report on 25 February 2009 and their recommendation provided the basis for legislative proposals by the Commission later that year.

According to De Larosière Report (2009), a key lesson to be drawn from the crisis is the urgent need to upgrade macro-prudential supervision in the EU for all financial activities. In the report of the High Level Group, it is stressed that central banks have a key role to play in a sound macro-prudential system. However, in order to be able to fully play their role in preserving financial stability, they should receive an explicit formal mandate to assess high-level macro-financial risks to the system and to issue warnings where required.

The High Level Group recommends establishing a new independent body, the European Systemic Risk Board (ESRB), responsible for safeguarding financial stability by conducting macro-prudential supervision at the European level. The ESRB includes the members of the ECB General Council plus the Chairs of the three European Supervisory Authorities (EBA, ESMA, EIOPA)\(^\text{10}\) and a member of the European Commission. To ensure appropriate geographical coverage and a well-balanced composition, the De Larosière Report proposes ECB involvement via the ECB General Council, which includes the President of the ECB, the Vice-President of the ECB, and the governors of the NCBs of all 27 EU Member States, rather than that of the Governing Council (which includes only the euro-area members).

The main task of the ESRB is to make assessments of stability across the EU financial system in the context of macro-economic developments and general trends in financial markets. In case of significant stability risks, the ESRB provides early warnings and, where appropriate, issues recommendations for remedial action. The addressees of warnings and recommendations are subsequently expected to act on them unless inaction can be adequately justified.

But financial stability tools are needed

The Dodd-Frank Act and the De Larosière Report are silent on the tools for macro-prudential supervision (that is financial stability). However, the Fed and the ECB need tools to actively manage financial stability. Tinbergen, one of the first winners of the Nobel Prize for economics, already showed that one instrument is needed for each policy goal. Central banks have two goals: monetary and financial stability. They have a clear instrument, setting the interest rate, to serve monetary policy. It also needs a clear instrument for financial stability. The Fed and the ECB can then pro-actively decide about applying the tool.

Two different tools have been proposed. The first proposal is to revisit Basel’s system of capital requirements and make it more cycle-neutral (e.g. Brunnermeier et al., 2009; Kremers and Schoenmaker, 2009). The Basel system is geared towards the stability of

\(^{10}\) See the chapter on Financial Supervision in the EU (Schoenmaker, 2011) on the new European Supervisory Authorities.
individual financial institutions, and does little to take account of their interaction with their environment and its stability. Capital requirements that “breathe with the cycle” may help avoid banks overly expanding credit when capital is ample in boom-time and, conversely, help avoid them tightening credit in the aftermath precisely when this is least conducive to financial stability. A simple way to introduce countercyclical capital buffers is to scale the minimum capital requirement multiplicatively. When credit or GDP growth is at its neutral level, the multiple is set to 1. If credit/GDP growth is above trend, the multiple is proportionally set above 1. Vice versa, the multiple is set below 1, if credit/GDP falls below trend. The challenge is to get a proper indicator for credit and GDP growth and to establish the required adjustment to the minimum capital requirement.

A second proposal is to impose liquidity charges. Perotti and Suarez (2010) argue that in all crises that spread beyond the original shock, liquidity runs forcing fire sales are a main cause of propagation. If systemic crises involve liquidity runs, which only liquidity insurance by central banks can absorb, then it is appropriate for the central bank to be responsible to monitor the buildup of risk and to manage the liquidity insurance provision with effective tools. Perotti and Suarez (2010) propose to establish a mandatory liquidity charge, to be paid continuously during good times to the central bank, which in exchange will provide emergency liquidity during systemic crises. The charge would be set according to the principle that future regulation should work like Pigouvian taxes on pollution, discouraging bank strategies that create systemic risk for everyone. Hence, it should be increasing in the maturity mismatch between assets and liabilities, and should be levied on all financial institutions with access to the LOLR. So, if the central bank observes an increase in short term funding of a bank (while asset maturities remain constant), it will increase its liquidity charge for that bank.

Information challenge
Timely information on the condition of financial institutions and markets is crucial to make an up-to-date assessment of the stability of the financial system and to act swiftly when needed (Schoenmaker, 2010). A key challenge for these new financial stability boards is the flow of information between the various participants. In particular, will the supervisory agencies, which are closest to the financial institutions, be prepared to inform, in a timely and comprehensive manner, the other members of the financial stability board. The rivalry between the US supervisory agencies is well known. An additional challenge for the ESRB, is a full flow of information from national central banks (NCBs) and national supervisors to the ECB. Game theory suggests that the envisaged arrangements are not incentive compatible. The ECB has a mandate for the stability of the EU-wide financial system (European mandate), while the remit of NCBs is limited to the stability of their respective national financial system (national mandate). If the interests of the ECB and the NCBs are aligned, NCBs may provide the necessary information to the ECB. But if there is a conflict of interests between a NCB and the ECB, there is no incentive for this NCB to provide timely information (Cihák and Decressin, 2007). A case in point are emerging problems with a national bank in one of the EU Member States. While a NCB may have an incentive to help a major player of their national banking system and to wait (and hope) for better times (forbearance), the ECB may want to act swiftly to prevent the problems spreading to the wider EU financial
system (prompt corrective action). However, without the information from the NCB that is closer to the ailing bank, the ECB cannot act timely.

6. Conclusions

Central banks are currently facing major reforms to foster their financial stability role. Financial stability departments are expanded. In a way, central banks are going back to their roots. Most central banks were established in crisis times (most notably during wars to finance governments) and took on the role of financial crisis management in their early days. After the World War II the focus has been tilted towards monetary policy. This monetary bias is now reversed. Monetary and financial stability are two sides of the same coin.

While the structures for financial stability (the hardware) are put in place, the analytical models and the macro-prudential tools (the software) are still in development. There are major challenges to develop the appropriate tools and to apply them. We should move from issuing warnings, which are often ignored, to applying tools based on a proper legal framework. A key issue is the timely application of these tools: timely action by the central bank may nip an asset price bubble in the bud. Most academic economists favor a rule based system to ensure that the macro-prudential tools are kicking in in time. Most central banks favor discretion because each situation is unique. That brings us back to the long standing central banking debate on rules versus discretion.
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