

## FINANCIAL STABILITY, SYSTEMIC RISK AND MACROPRUDENTIAL POLICY

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*This article aims to open a debate on creating a macroprudential policy framework in the Czech Republic. It starts by describing how the CNB defines financial stability and what place macroprudential policy has within it. It then gives the sources of systemic risk and outlines the mechanisms which lead first to the accumulation and subsequently to the materialisation of such risk. It goes on to compare the operational framework of macroprudential policy with the traditional monetary policy framework. Tools and actions which can be included in the financial stability and macroprudential policy toolkit are subsequently incorporated into this framework.*

“ ... in tracking systemic risk ... we should avoid a false sense of precision ... it is better to be approximately right than precisely wrong”  
Borio (2010, p. 9)

### 1. INTRODUCTION

Ways of incorporating a new pillar – macroprudential policy – into the financial stability toolkit have started to be discussed at various levels (international, European and national) in response to the global financial crisis. In the EU, this debate has led to the creation of the European Systemic Risk Board (ESRB), which is set to become the European authority for macroprudential oversight. Numerous initiatives have also been set up to produce macroprudential regulations. Some of these have already been incorporated into the “Basel III” proposals of the Basel Committee on Banking Supervision (see BCBS, 2010a). Others are being discussed or prepared by other international authorities, specifically the European Commission at EU level and the Financial Stability Board at global level.

This article aims to open a debate about how the concept of macroprudential policy should be developed in the Czech Republic in the coming years given its financial market structure, its existing monetary policy regime and its historical experience with regulating and supervising financial institutions over the preceding two decades. The article includes descriptions and definitions of a whole range of terms and concepts that have started to be used routinely – and often also inaccurately – in the debate on the pursuit of financial stability goals through macroprudential policy. The starting point for realising the aim mentioned above is *the CNB’s financial*

*stability concept*, which has been applied since 2004. The original narrowly defined macroprudential policy framework advocated by economists from the Bank for International Settlements (BIS)<sup>1</sup> will be incorporated into this starting concept and supplemented by information obtained from assessments of the causes of the latest global financial crisis.

The article is structured as follows. Section 2 examines the objective of financial stability and defines macroprudential policy and systemic risk. Section 3 focuses on the time dimension of systemic risk – procyclicality and the financial cycle – and section 4 deals with the cross-sectional dimension of systemic risk. Section 5 describes methods for identifying and assessing the magnitude of systemic risk. Section 6 compares the operational frameworks for macroprudential and monetary policy, and Section 7 presents individual macroprudential policy tools, putting them into context with various phases of the financial cycle and different sources of systemic risk. Section 8 concludes by summarising the main aspects of the macroprudential policy framework. The article will not deal in any depth with the full spectrum of systemic risk sources, analysis and instruments that are currently included in the field of financial stability. It will instead focus on the part of the spectrum that is macroprudential in nature and is simultaneously relevant to the CNB given the structure of the Czech financial sector and economy as a whole.<sup>2</sup>

1 One of the consequences of the ongoing “macroprudential revolution” is that the multi-dimensional concept of macroprudential policy is getting more and more blurred. Until 2008, the term “macroprudential” was used almost exclusively in the context of BIS analyses focused primarily on risks associated with the financial cycle. Since then, it has become a highly fashionable expression used in an increasingly wide context moving further and further away from its original meaning (see discussion in Clement, 2010; Borio, 2010). The main papers by BIS economists which defined the original concept of macroprudential policy are Borio (2003), Borio and White (2004) and White (2006).

2 This article does not examine the role of monetary policy in supporting financial stability or the links between monetary policy, asset prices and financial stability. Detailed discussions of these issues are presented by Frait, Komárková and Komárek (2011) and Zamrazilová (2011).

## 2. FINANCIAL STABILITY AND MACROPRUDENTIAL POLICY

There is currently a consensus in the central bank community that the *financial stability objective* is to achieve a level of stability in the provision of financial services (i.e. lending, insurance, execution of payments, etc.) over the entire business cycle which will support the economy in attaining maximum sustainable economic growth. The CNB adopted a definition consistent with this current thinking about the financial stability objective back in 2004. It defines *financial stability* as a situation where the financial system operates with no serious failures or undesirable impacts on the present and future development of the economy as a whole, while showing a high degree of resilience to shocks. Another core element of the CNB's financial stability framework is its definition of *financial stability analysis* as the study of potential sources of systemic risk arising from the links between vulnerabilities in the financial system and potential shocks coming from various sectors of the economy, the financial markets and macroeconomic developments.

The aforementioned definitions explicitly emphasise the *macroprudential orientation of the CNB's financial stability policies*. Figure 1 shows that the job of these policies is to ensure that the financial system does not become so vulnerable that the shocks ultimately cause financial instability in the form of a crisis. The CNB's financial stability analyses contained in its Financial Stability Reports are therefore focused on determining whether weak spots are forming in the financial system which might reduce its resilience to shocks and whether conditions are being created in which the interaction of macroeconomic factors

and policies, excessive household, corporate, government or financial institution debt, and financial market volatility could cause a financial crisis.

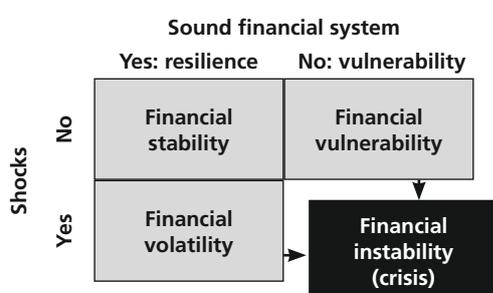
The main, although not only, element of financial stability policy is *macroprudential policy*. The primary distinguishing feature of macroprudential policy is that unlike traditional microprudential regulation and supervision (focused on *the resilience of individual* financial institutions to mostly *exogenous* events) it focuses on the stability of the system as a *whole*. It primarily monitors *endogenous processes* in which financial institutions that may seem individually sound can get into a situation of systemic instability through common behaviour and mutual interaction.<sup>3</sup> The only "true" macroprudential policy instruments are those which are explicitly focused on the financial system as a whole and on the endogenous processes going on within it. Other measures that can be used to a certain extent to support financial stability and can also have macroprudential aspects include microprudential regulatory and supervisory instruments and monetary, fiscal and tax policy tools (for more details see section 7).

The *macroprudential policy objective* is to prevent systemic risk from forming and spreading in the financial system and thereby reduce the probability of occurrence of financial crises with large real output losses for the entire economy.<sup>4</sup> By suppressing channels of formation and spread of systemic risk, macroprudential policy should therefore act primarily preventively against signs of financial instability in the future and secondarily at least to mitigate their impacts if prevention fails.

The object of macroprudential policy is systemic risk, which has two main dimensions. The *time dimension* reflects the build-up of systemic risk over time. The source of this dimension is *procyclicality* in the behaviour of financial institutions contributing to the formation of unbalanced financial trends, which sometimes slip out of the control of institutions themselves or their regulators (see, for example, Brunnermeier et al., 2009 or Borio and Drehmann, 2009a). Systemic risk of this type manifests itself primarily as correlated exposures to the same macroeconomic factors across financial institutions (section 3). The second dimension of systemic risk is *cross-sectional* and reflects the existence and distribution of systemic risk at any given moment in time.

FIGURE 1

### STABILITY STATES OF THE FINANCIAL SYSTEM



- The job of financial stability analysts is to avoid risks due to the fallacy of composition, which arises when the whole is wrongly assessed only as the sum of mutually independent parts.
- Reinhart and Rogoff (2009) document that systemic crises have a long-term negative impact on economic activity. In such crises, GDP contracts for a period of around two years on average and returns to its original trend only after four years.

The source of this dimension is mutual and chained exposures among financial institutions (section 4). Such institutions can underestimate the potential impact of their own activities on the risk of the financial network as a whole, thereby creating negative externalities for other parts of the system.

The time and cross-sectional dimensions to a large extent evolve jointly and so cannot be strictly separated. In a growth phase of the financial cycle, rapid credit growth is accompanied by a growing exposure of a large number of banks to the same sectors (usually the property market) and by increasing interconnectedness in meeting the growing need for balance-sheet liquidity. Financial institutions become exposed to the same concentration risk on both the asset and liability side. This makes them vulnerable to the same types of shocks and makes the system as a whole fragile. The time dimension shows up in degree of solvency, while the cross-sectional dimension manifests itself in the quality of financial institutions' balance-sheet liquidity. However, solvency and liquidity are also interconnected, as liquidity problems often transform quite quickly into insolvency.

From the general perspective, and given the character of the Czech economy and its financial system, the time dimension of systemic risk can be regarded as dominant. Empirical analysis of the history of financial crises reveals that the financial cycle – whose primary features are changes in credit growth and in the level of debt of economic agents – usually lies at the heart of systemic financial crises with strong negative impacts on output. The 1997–1999 crisis in the Czech Republic and the 2007–2009 global crisis were both of this nature. However, the cross-sectional dimension should not be underestimated either. Especially in a small open economy, connections between institutions in the domestic economy and their links with the international economy can both be sources of contagion. While acknowledging the greater importance of the time dimension, the approach to macroprudential policy must therefore cover both dimensions.

Given the aforementioned characteristics of systemic risk, *macroprudential policy* can be defined as the application of a set of instruments that have the potential to reduce the vulnerability and thereby increase the resilience of

the system by creating capital and liquidity buffers, by limiting procyclicality<sup>5</sup> in the behaviour of the financial system or by containing risks that individual financial institutions may create for the system as a whole.

### 3. PROCYCLICALITY, THE FINANCIAL CYCLE AND SYSTEMIC RISK

The combination of liberalised financial markets and their increased procyclicality since the 1990s has made economies prone to *endogenous boom and bust cycles*. In good times, financial institutions and their clients can start to underestimate the risks associated with their economic decisions or, in an environment of increased competition, can even be exposed to strong incentives to take on bigger risks. A major incentive for such behaviour is easier access to external financing, which is strongly dependent on current risk perceptions reflecting the currently high economic activity. If economic agents start to misconstrue a temporary cyclical improvement in the economy as a long-term increase in productivity, virtuous cycle can start to develop, supported by an increased willingness of households, firms and government to accept a higher level of debt and use it to buy risky assets. Such cycles are common in converging economies, where it can be particularly difficult to distinguish between long-term productivity gains (due, for example, to the positive effects of foreign direct investment) and cyclical improvements.

This sets off a spiral (positive feedback loop) manifesting itself as a decreasing ability to recognise risk, trend growth in asset prices, weakened external financial constraints and high investment activity supported by output growth, increased revenue growth and improved profitability. In the background of this cycle, financial imbalances grow and systemic risk builds up unobserved. This often shows up openly later on, when economic starts to weaken as a result of a negative stimulus. Recession subsequently sets in and the spiral turns around. Economic agents realise that their income has been rising at an unsustainably high rate, they are burdened with too much debt, their asset holdings have fallen in value and so they need to restructure their balance sheets. In this situation, banks and their clients can, by contrast, start to display excessive risk aversion.

<sup>5</sup> Procyclicality of the financial system means its ability to magnify swings in the economic cycle through lending and other activities of financial institutions as a result of feedback between macroeconomic developments and the financial system.

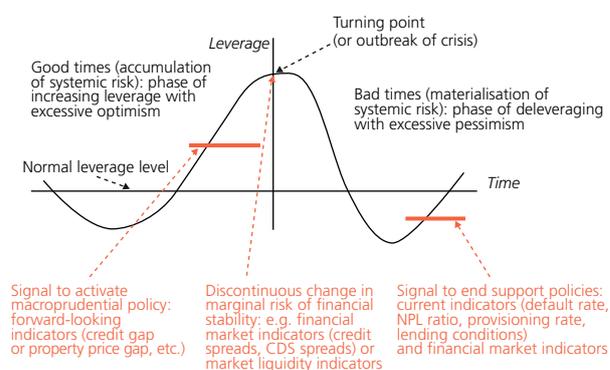
To a large extent, these processes are as natural as the business cycle itself. However, the financial imbalances can sometimes get too big and, as a result, a dangerous vicious cycle can arise in the contraction phase. If the desirable adjustment is combined with strong increase in general uncertainty, a sharp fall in access to external financing due to capital or balance-sheet liquidity problems in banks, and with panic selling of overvalued assets, the downward movement can become very rapid and destabilising. The most recent episode of financial instability, which started in 2007, was largely global in nature and entailed huge macroeconomic costs. Even though the Czech financial system remained stable during the crisis and was exposed only to its indirect effects, it will take the Czech economy at least three years to return to its pre-crisis output level (as in the previous crisis of 1997–1999). For the hardest-hit countries, this process will take much longer.<sup>6</sup>

All this implies that the main source of the time element of systemic risk is the *financial cycle*<sup>7</sup> and one of the primary objectives of macroprudential policy must therefore be to create incentives for financial institutions to behave less procyclically (Geršl and Jakubík, 2010). A key variable describing the evolution of the financial cycle over time is *leverage*. In its narrower sense, this term<sup>8</sup> concerns the relation between the assets of an economic agent and the debt that was used to acquire them. In its increasingly used broader sense, it approximates the overall nature of the financial cycle and the position of a given economy within it (the indebtedness of economic agents, stocks and dynamics of loans, the availability of external financing, the size of interest rate margins and credit spreads, the ratio of assets and capital in financial institutions, the length of lever of financial market investors, etc.).

Chart 1 shows the evolution of leverage over the financial cycle. The leverage increases until the financial cycle turns over. Sometimes the turn is disorderly and presents itself

CHART 1

## THE FINANCIAL CYCLE AND THE EVOLUTION OF SYSTEMIC RISK



as the eruption of financial crisis. Leverage then starts to decline, although in the early phase of the crisis it remains high (given falling nominal GDP it can even rise in the initial post-crisis years). The deleveraging phase can therefore last several years, and in the event of a deep crisis the leverage ratio can, after a time, fall below its long-term normal value. Although the leverage level is high on both sides of the crisis point, the economic situation is very different on either side. In the pre-crisis optimistic phase there is a financial boom going on, whereas in the post-crisis phase the economy is exposed to financial stress. Consequently, the leverage ratio adjusts to economic conditions after a considerable lag, so stock measures have only a limited information value as a guide for the macroprudential policy response during the financial cycle. For this purpose, in section 5 we will define forward-looking variables that can be used to identify situations where the tolerable limit for systemic risk has been exceeded. Likewise, we will define indicators of the start and end of the financial instability phase and indicators for determining the scale and seriousness of an ongoing systemic risk materialisation phase.

- 6 Another danger of such crises is that they can give rise not only to output losses, but also to other long-term economic efficiency losses as a result of a potentially incorrect economic policy response, including in terms of financial market regulation. Significant efficiency losses may also arise in response to the current crisis owing to the introduction of ill-conceived measures adopted under political and time pressure as part of the regulatory “whirlwind” in the EU and the USA.
- 7 We can define the financial cycle as a process in which mutually strengthening credit creation and asset price behaviour amplifies the business cycle, resulting, under certain conditions, in a financial crisis due to excessive debt manifesting itself as financial stress and major macroeconomic disturbances. The credit expansion and subsequent credit contraction in this process have a strong effect on the volatility of real economic activity and in particular on the allocation of capital, with excess capacity being first created and then being liquidated (usually most visibly in the construction sector). Moreover, the financial cycle precedes and to a large extent causes the risks that are characteristic of the cross-sectional dimension.
- 8 The term leverage is used in number of areas and therefore has number of different definitions. In the financial market area it generally describes the ratio between the total investment and own funds of an investor and indicates the degree of use of borrowed external funds. In the case of banks, it referred, for example, to the assets-to-equity ratio.

#### 4. THE FINANCIAL NETWORK AND THE RISK OF CONTAGION WITHIN THE FINANCIAL SYSTEM

The financial crisis has demonstrated that in order to ensure financial stability it is not enough to have financial institutions that are individually sound and resilient to fundamental risks. It is also vital to track and assess the links between them, because efforts to enhance the financial position of one institution can paradoxically undermine the stability of another institution or of the system as a whole. The links between individual financial institutions can act as channels through which shocks or contagion can propagate. *Contagion* thus stands at the centre of the cross-sectional element of systemic risk. Owing to a shortage of information, a financial institution is not itself usually capable of judging what effect its behaviour will have on other institutions in the system. For the same reason, it is not capable of defending itself sufficiently against the negative impacts of the behaviour of others. This means that if a financial institution is part of the financial network, it bears *network risk*, which it cannot effectively defend itself against or otherwise hedge against (Haldane, 2009). However, whether negative shocks are propagated or absorbed within the financial network depends on the phase of the financial cycle (see above).

Contagion channels can be divided into two types (Dijkman, 2010): real and information. The *real channel* refers to the direct knock-on effects from a stressed institution (or market or infrastructure) to others through direct links (such as existing gross exposures or financial flows through payment systems). Literature from the 1990s (Rochet and Tirole, 1996) draws attention to the dangers of excessively large exposures between banks, especially in the case of the unsecured money market. It points out that the benefits of interconnectedness in the form of risk-sharing between financial institutions always come at the expense of contagion risk.<sup>9</sup>

The spread of contagion through the *information channel* is much simpler, but more difficult to predict. Information

contagion can be defined as a sudden and sometimes also unexpected change in the behaviour of economic agents, which can take the form of herd behaviour (when diverse investment categories are bucketed together in the same high risk category), information cascades (when every agent chooses the same action, regardless of his own private information), or sudden reappraisals of economic fundamentals (so-called sunspots; Vaugirard, 2007).<sup>10</sup> The current crisis has demonstrated that asymmetric information, which leads to the phenomenon of adverse selection (Kwan, Flandery and Nimalendran, 1996), contributed significantly to the spread of the crisis. The inability of banks or other creditors to distinguish between good and bad assets or counterparties led to reduced lending and accumulation of liquidity and caused the money market to stop functioning (Ferguson et al., 2008).

The contagion effect within the financial system can be illustrated with the aid of a contagion matrix composed of the three main parts of the financial system – institutions, markets and infrastructure – and their principal interconnections (see Table 1).

The intricate structure of the linkages within a modern financial system can also be illustrated and tracked by means of network analysis (see Chart 2; e.g. Upper, 2007, Allen and Gale, 2000, Freixas, Parigi and Rochet, 2000, and Nier et al., 2007).

*Network analysis* essentially involves defining a collection of nodes (financial institutions or markets) and the direct and indirect links between them (credit relationships, exposures, liquidity flows in the payment system, etc.). As a consequence of the current financial crisis, a “too interconnected to fail” paradigm has emerged alongside the traditional “too big to fail” paradigm. Parameters for identifying important nodes (a concept known in social network analysis as centrality) have come to the fore.<sup>11</sup> The importance of a key financial institution (or market)

<sup>9</sup> However, the risk of contagion within the financial network depends to a large extent on the network type (complete, random or scale-free; ECB, 2010) and also on the quality of the links.

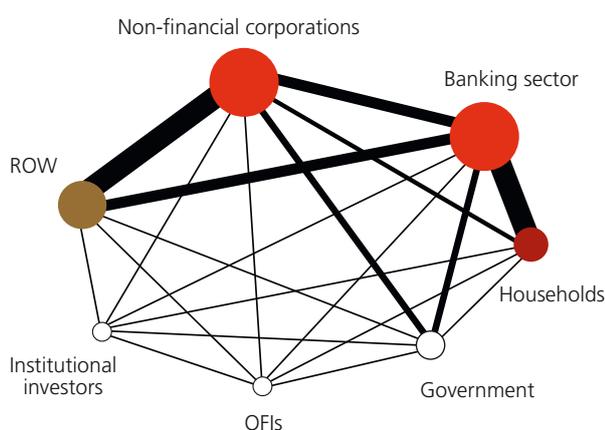
<sup>10</sup> The type of triggering event can play a significant role in the impact intensity of a negative shock. The triggering event can be an idiosyncratic shock (e.g. problems within a single bank) which then spreads to the financial system through propagation channels, but it can also be a systematic shock (e.g. an unsustainable fixed exchange rate) which hits several institutions at the same time. Several idiosyncratic shocks can exist in the system simultaneously, spreading and escalating inside the system through propagation channels.

<sup>11</sup> The properties and behaviour of a node cannot be analysed on the basis of its own properties and behaviour alone, as these may be affected by other nodes linked to it either directly or via another node. An important node can be defined according to the following criteria: (i) the function it performs is important for the business of other nodes in the system, (ii) its balance sheet and transactions are relatively large, and most importantly (iii) its function cannot be assumed by anyone else within a reasonable time and at a reasonable price. Using these criteria, which should, moreover, be relatively stable in the medium term, it is possible to identify a key financial institution, market or infrastructure – e.g. a large and active bank, the largest credit market in terms of transaction volume and frequency, a central counterparty or a large-value payment system (ECB, 2006).

**TABLE 1**
**THE CONTAGION MATRIX**

		Contagion to		
		Institutions	Markets	Infrastructure
Contagion from	Institutions	credit risk exposures, shareholder links, contingent credit lines, access to key financial infrastructure	market makers for derivatives, provision of credit support through CDSs, fire sales of assets	operational disturbances
	Markets	investment losses in the trading and available-for-sale portfolio, losses through the revenue channel, problems with funding and liquidity management	information channel – sudden loss of confidence	margin calls (financial asset prices may come under pressure)
	Infra-structure	delays in incoming and outgoing payments complicating liquidity management	operational disturbances in system can negatively affect market turnover and distort price formation	supporting services, technical links and connected ICT systems can spread disruptions

Source: Dijkman (2010)

**CHART 2**
**ILLUSTRATION OF FINANCIAL LINKS IN THE CZECH ECONOMY**


Source: Authors' calculations using data from Komárek, Kubicová and Plašil (2011)  
 Note: OFIs: other financial intermediaries; ROW: rest of world. Node size is given by the sum of the assets and liabilities of the relevant sector (excluding the ROW node), while link strength is given by gross exposure between the relevant nodes. The ROW node reflects only the sum of the gross exposures that Czech sectors have w.r.t. the rest of the world (usually equity holdings). The size of the other nodes is additionally given by intra-sectoral links. Based on data as of 2010 Q2.

is therefore measured not only by its absolute size, but also by its interconnectedness with other financial institutions (ECB, 2010).<sup>12</sup> Consequently, the measurement of importance combines two aspects: the functionality of

the institution or market within the system, and the degree to which others in the system rely on the smooth provision of services by the given institution or market. Moreover, the systemic relevance of an institution can increase over time, especially in the growth phase of the financial cycle. If the system contains an important node that is irreplaceable by others in the system, the system as a whole will be as vulnerable to shocks as the important node is.<sup>13</sup> Financial networks containing several important nodes can therefore be extremely volatile and vulnerable. A shock might affect just a few of them, or even just one, but if they are heavily intertwined within the system – and especially with other important nodes – a sudden breakdown in the provision of their services will lead almost certainly to propagation of the shock and probably also to amplification of its impact on the system as a whole.

Contagion in the systemic risk sense is not limited to the financial system alone (the horizontal perspective). Negative shocks also propagate from the financial system to the real economy (the vertical perspective). This means that a systemic event or systemic risk spreads out of the financial system via the real or information channels to the real economy and affects consumption, investment, economic growth and overall wealth. The opaque and intertwined nature of the financial system magnifies or accelerates the impact of such a shock. The objective of macroprudential policy in this regard is to adopt measures

<sup>12</sup> Traditional measures of centrality include the number of links that terminate on a node (in-degree) or that depart from a given node (out-degree), or the distance from other vertices (closeness) via the shortest paths.

<sup>13</sup> The collapse of Lehman Brothers in September 2008 was a classic example of a transformation in behaviour from a pessimistic and disorientated mood into full-blown panic (Tett, 2009) that paralysed the money market. As the money market can be regarded as a typical important node, it was vital for some other node to assume its function. As the money market is quite difficult to replace by another market, it was replaced by central banks, which gradually introduced unconventional monetary instruments.

to reduce the size or interconnectedness of systemically important nodes<sup>14</sup> or to make them more resilient to systemic shocks.

## 5. IDENTIFICATION AND ASSESSMENT OF SYSTEMIC RISK

*The two main tasks of macroprudential policy* – to prevent systemic risk and, if prevention fails, to mitigate the impacts when it materialises – are given by the existence of two phases of development of systemic risk. From the prevention perspective, the main task of financial stability analysis is timely identification of the marginal contribution of the current financial environment to the *accumulation* of systemic risk (see the left-hand side of Chart 1). This contribution, which can be termed *the risk of future financial instability*, adds to the build-up of systemic risk in a phase of increasing leverage against a backdrop of easy access to cheap credit and over-optimistic expectations regarding future income and asset prices. At a certain moment, however, economic agents will radically revise their expectations as a result of particular information or a particular event, and a change will occur. Aspects of crisis will start to become apparent and a phase of materialisation of the risk accumulated in the preceding phase will occur in the form of financial instability. Banks will revise upwards their view of the credit, market and liquidity risk in their balance sheets, increase their credit margins or credit spreads, and tighten their lending conditions. Subsequently, a process of deleveraging will start, during which the systemic risk will gradually “de-accumulate”.

Chart 1 illustrates how the process of accumulation of systemic risk (on the left-hand side) is followed by the materialisation of systemic risk (on the right-hand side). The magnitude or intensity of materialisation is easier to observe. Compared with the risk of financial instability, it has the opposite time profile. This is a reflection of the *financial stability paradox*: sources of systemic risk have a tendency to increase when banks and their clients consider their business risks to be the lowest. In other words, a system is most vulnerable when it looks most robust. In boom times, when the risk of future financial

stability is increasing, the current indicators of existing financial risks are usually improving – default rates and NPL ratios are falling and banks are provisioning to a lesser extent and reporting smaller credit losses. On the basis of current risk measures, the resilience of the financial sector can seem very high at such times.

Success in pursuing financial stability is to a large extent a function of the authorities' ability to identify and correctly assess the sources and evolution of systemic risk over the financial cycle. With regard to the two main tasks of macroprudential policy – *prevention and mitigation* – the competent authorities (the CNB in the case of the Czech Republic) must in boom times focus on assessing the risk of future financial instability and during crises on assessing the scale of the risk materialisation problem. The primary objective must be *to act preventively against growth in systemic risk in the risk accumulation phase*, when conditions are being created for future financial instability. During this phase, macroprudential analyses must be focused primarily on the identification of *latent risks* being generated in the balance sheets of financial intermediaries and their clients. Analytical attention, however, must also be paid to the quality of cash flows, as financial institutions with structural problems in their balance sheets (e.g. weak balance-sheet liquidity or excessively long maturity transformations) are naturally far more prone to cash-flow problems.

When identifying hidden risks, it is important to realise that *current indicators* based on the present levels of financial variables provide information about the degree of materialisation of systemic risk, but not about the probability of occurrence of financial instability in the future.<sup>15</sup> In pursuing their objectives, however, authorities must focus on a set of *forward-looking indicators* providing information on the possibility of the future materialisation of systemic risk as a result of currently emerging financial imbalances. This refers mainly to “gap” indicators based on the assessment of deviations of factors determining the degree of leverage from their normal or equilibrium values.<sup>16</sup> For example, deviations of the ratio of credit to the private sector to GDP<sup>17</sup> or the ratio of property prices

<sup>14</sup> Such measures can include money market financing caps or additional regulatory capital requirements for highly interconnected institutions.

<sup>15</sup> In this sense, in the pre-crisis period the CNB regularly drew attention in its analyses and its Financial Stability Reports to the fact that the existing NPL ratio could not be considered evidence of low risk, since at a time of rapid credit growth, new loans, which are naturally of higher quality initially, dilute the proportion of problem loans.

<sup>16</sup> A complicating factor is the fact that the risk of financial instability emerges at longer and irregular intervals, reflecting the fact that the financial cycle is usually longer than the normal business cycle.

<sup>17</sup> See the thematic article *Excessive Credit Growth as an Indicator of Financial (In)Stability and its Use in Macroprudential Policy*.

to income from their long-term trends would seem to be relatively reliable indicators. Such indicators send out a signal several years ahead about financial imbalances in financial institutions' balance sheets and about the potential for the creation of dangerous bubbles (for more details, see Borio and Drehmann, 2009).<sup>18</sup> There is an extensive debate in the economic literature about the possibility of using forward-looking indicators to construct early warning systems (EWSs; see Alessi and Detken, 2009). EWSs are used on the practical level by, for example, the International Monetary Fund (IMF-FSB Early Warning Exercises). However, their information value and practical applicability remain limited (Ghosh et al., 2009).

Thanks to the financial stability paradox, current indicators can also be used in the identification of the accumulation of systemic risk. Where the values of current indicators (such as the NPL ratio, the default rate or the provisioning rate) are significantly "better" than their usual values or their historical means, this can be regarded as an indicator of a growing risk of financial instability. Such indicators can be regarded as complementary to forward-looking indicators and as applicable primarily for determining the position in the financial cycle or estimating the probability of a change in the financial cycle.

For a small and very open economy such as the Czech Republic, risk sources associated with the economy's links with the external environment have specific significance. In its financial stability analyses, therefore, the CNB traditionally puts great emphasis on vulnerabilities resulting from internal and external macroeconomic imbalances and negative international positions of the financial sector. If the economy is strong in these areas, its susceptibility to contagion from abroad is greatly reduced (this was confirmed in the case of the Czech economy in the acute phase of the crisis in late 2008 and the first quarter of 2009). If, on the contrary, the economy is vulnerable in these areas, it can be hit relatively easily by financial instability as a result of a sharp change in capital flows, financial market volatility linked with public debt financing, or the drying-up of sources of balance-sheet liquidity from abroad.

When assessing systemic risk during the accumulation phase, authorities must first of all reach a general consensus on the normal or sustainable values of the relevant indicators and then continuously assess whether the deviations of actual values from normal levels are becoming critical. In the systemic risk *accumulation phase*, this process will not be easy. It is quite difficult to distinguish normal cycle fluctuations and long-term trends from a dangerous financial cycle in timely fashion. Preventive macroprudential tools are not usually activated until a consensus has been reached that the critical values of individual indicators – or rather a combination of a set of forward-looking indicators – that have a strong information content regarding the current level of risk of future financial instability have been exceeded. These indicators of the time dimension of systemic risk will also have to be used when assessing the moment at which the pre-materialisation effects are ceasing to act in a systemic fashion and the anti-crisis measures and support policies can therefore be discontinued. These two critical moments that macroprudential analysis is tasked with identifying are marked by red lines in Chart 1.

If prevention is not sufficiently effective and a systemic risk *materialisation phase* occurs, the macrofinancial policy focus must be shifted to *mitigating the impact of the crisis*. The start of this phase is usually quite easy to identify, since the onset of a crisis tends to be clearly visible thanks to a sharp deterioration in market variables (e.g. credit spreads or CDS spreads). In this phase, it is vital to assess the financial system's ability to withstand the emerging risks. *Stress tests* of the financial system's resilience are a suitable analytical instrument for performing this task. With the aid of such tests, supervisory authorities should be able to estimate whether the financial sector will withstand the adverse effects associated with risk materialisation at the given level of capital and liquidity.<sup>19</sup> In addition to stress tests, the aforementioned current indicators in stock or flow form can be used to estimate the extent of financial stress.

<sup>18</sup> It is much more difficult to obtain reliable forward-looking indicators of the cross-sectional dimension of systemic risk. Such indicators are often obtained from prices on financial markets. However, their reliability as risk indicators is reduced by the limited efficiency of financial markets.

<sup>19</sup> Stress tests can be an important analytical tool in the systemic risk accumulation phase as well. That said, they remain primarily an indicator of resilience in the materialisation phase. This is due to two factors. First, they are based primarily on current risk indicators, which in good times are usually low in value and the starting position of the segment of the financial system under test therefore tends to be relatively strong. Consequently, the results of stress tests conducted in good times often have a limited information content even for high-stress scenarios. In bad times, by contrast, when the starting position of the relevant segment is fragile, and additional stress can have a much more visible effect. Second, in their current form, stress tests are focused on evaluating the impacts of mostly exogenous shocks. As the stress test methodology is gradually developed and more endogenous mechanisms are added, the information content and applicability of stress tests in the risk accumulation phase can be expected to increase.

In a small open economy, financial or informational contagion resulting from links between the economy and its institutions and the external environment can be a major source of materialisation of systemic risk and of discontinuities in the evolution of such risk. The analytical approach to identification and assessment will differ significantly from country to country depending on factors such as the share of foreign ownership of finance institutions, the dominance of subsidiaries or branches of foreign banks, the share of foreign currency loans, and the net external and foreign exchange position of the banking sector and the economy as a whole.

Indicators for the two phases of development of systemic risk and for the two dimensions of systemic risk are listed in Annex 1.

## 6. OPERATIONAL FRAMEWORK OF MACROPRUDENTIAL POLICY

An important condition for efficient and effective implementation of macroprudential policy is operationalisation of that policy. In constructing such policy, the competent authorities should gradually head towards a similarly sophisticated operational framework as that currently applied in flexible inflation targeting. Table 2 outlines such a framework. As in the case of monetary policy, the use of tools in macroprudential policy-making should be accompanied by sophisticated and sometimes also forceful communication. At least in boom times, it may be necessary to complement macroprudential policy with monetary policy that “leans” against financial imbalances (see Borio and White, 2004, Zamrazilová, 2011,

TABLE 2

COMPARISON OF MONETARY AND MACROPRUDENTIAL POLICY FRAMEWORKS

	Monetary policy	Macroprudential policy
<b>Horizon</b>	<ul style="list-style-type: none"> <li>1–3 years</li> </ul>	<ul style="list-style-type: none"> <li>longer and more variable</li> </ul>
<b>Ultimate target</b>	<ul style="list-style-type: none"> <li>price stability, defined as maintaining low and stable inflation</li> <li>reasonable volatility of economic activity</li> </ul>	<ul style="list-style-type: none"> <li>preventing the formation and spread of systemic risk (reducing the probability of occurrence of financial crises with large output losses and/or costs for public budgets)</li> <li>mitigating the impacts of the materialisation of systemic risk if prevention fails</li> </ul>
<b>Indicators for identifying risks and assessing their intensity</b>	<ul style="list-style-type: none"> <li>inflation forecast in relation to target</li> <li>output gap, indicators of capacity utilisation and producers' profit margins, etc.</li> </ul>	<ul style="list-style-type: none"> <li>excessive debt measures</li> <li>asset overvaluation measures</li> <li>risk undervaluation measures</li> <li>excess liquidity indicators and property construction and trading activity indicators</li> <li>indicators of internal and external balance of the economy</li> <li>indicators of the external position of the financial sector</li> <li>extent of leverage among institutions and investors</li> <li>market funding ratio and other balance-sheet liquidity indicators</li> <li>asset and liability maturity and currency mismatch indicators (for details see <b>Annex 1</b>)</li> </ul>
<b>Intermediate targets</b>	<ul style="list-style-type: none"> <li>money market interest rates</li> <li>exchange rate</li> </ul>	<ul style="list-style-type: none"> <li>resilience and shock-absorbing capacity of the financial system</li> <li>amplitude of the financial cycle</li> <li>asset price volatility</li> <li>level of uncertainty regarding the soundness of the system at times of financial instability</li> </ul>
<b>Instruments</b>	<ul style="list-style-type: none"> <li>monetary policy interest rate</li> <li>foreign exchange market interventions</li> <li>other reserve requirement instruments</li> <li>communication</li> </ul>	<ul style="list-style-type: none"> <li>built-in stabilisers oriented towards creating and releasing buffers</li> <li>macroprudentially applied supervisory and regulatory instruments</li> <li>communication (for details see <b>Annex 1</b>)</li> </ul>
<b>Transmission mechanisms (instruments functioning via)</b>	<ul style="list-style-type: none"> <li>bank asset financing costs</li> <li>credit costs for bank clients</li> <li>foreign trade prices</li> <li>asset prices</li> </ul>	<ul style="list-style-type: none"> <li>bank capital and liquidity requirements</li> <li>banks' costs relating to the risk of new and existing exposures</li> <li>penalisation of increasing scale of risk assumed by banks and other financial institutions</li> </ul>

or Frait, Komárková and Komárek, 2011). As an integrated monetary and supervisory authority, the CNB introduced greater interconnectivity of monetary and macroprudential policy back in 2009. Members of the CNB Bank Board meet every quarter with experts from key sections in so-called *macro-financial panels* to discuss the current risk outlook. These panels take place before the Bank Board's monetary policy meetings discussing the CNB's new macroeconomic forecast and provide the participants with a comprehensive view of the economic and monetary situation.

The ultimate objectives of macroprudential policy were described in section 2. The *main intermediate target of the preventive instruments used in the accumulation phase of the time component of systemic risk* is to increase the resilience of the financial system by creating buffers which are then used in the period of materialisation of this risk.<sup>20</sup> Sufficient capital buffers and a suitable level of provisions increase the ability to absorb unexpected and expected losses, while stable balance-sheet liquidity enhances the ability to absorb source shocks. The secondary intermediate target is to reduce the amplitude of the financial cycle by suppressing lending growth and preventing excessively long maturity transformations. Experience with the use of macroprudential tools in some countries suggests that their individual effect on the financial cycle is limited (Borio, 2010). However, a combination of macroprudential tools and macroprudentially applied microprudential instruments (e.g. those which create additional capital requirements for risk exposures) could help to eliminate manifest excesses over the financial cycle. They might also contribute to enhancing the management of risks in individual institutions, including risks linked with cyclical increases in maturity transformations in bank financing and with the tendency of banks to rely on short-term market financing at times of easy access to liquidity.

A comparison of the individual aspects of the monetary and macroprudential policy operational frameworks (see Table 2) reveals that the macroprudential policy framework will always be associated with a higher degree of uncertainty and a lower level of accuracy than the monetary policy framework. This is due to the multi-dimensional nature of the financial stability objective, the generally longer length of the financial cycle than the monetary cycle, and more

complex transmission from macroprudential tools to changes in the behaviour of financial institutions and their clients. Macroprudential policy can therefore have a longer and more variable reaction horizon. Years can pass from the time the financial system becomes vulnerable to the time a financial crisis erupts. Then, however, the conditions suddenly change and the adjustment process is highly non-linear (a sharp transition from good to bad times). However, these factors do not necessarily rule out macroprudential policy, because – as the quote at the start of the article says – when analysing financial stability it is better to be approximately right than precisely wrong.

## 7. TOOLS FOR PREVENTING SYSTEMIC RISK AND MITIGATING ITS IMPACTS

After identifying systemic risk, authorities can use relevant tools to prevent it or mitigate its impacts. The two development phases and two dimensions of systemic risk can necessitate the use of different tools or combinations thereof. In the systemic risk materialisation phase, the macroprudential policy priorities will be to prevent the elements of instability from escalating, to reduce the probability of panic adjustment by financial institutions and their clients in response to the revision of expectations, and to mitigate the negative impacts of the significantly worse conditions. Countercyclical buffers created in good times can be regarded as the most important macroprudential tool for this phase. In a systemic crisis, however, a whole range of monetary policy instruments and regulatory and supervisory measures can become macroprudential in nature. On a concrete level, macroprudential policy in this phase will act via built-in stabilisers (the release of buffers and the use of central banks' automatic facilities) or crisis management tools (government guarantees for bank assets, bad asset transfer programmes and balance-sheet cleanups, and capital injections for ailing institutions). Active communication with the financial markets and the public, including disclosure of stress tests results, in order to reduce the level of uncertainty about the stability of the financial sector will also be important. For example, the CNB moved into more active communication mode during the financial crisis and since February 2010 has been providing the public

20 The main point of macroprudential buffers is to reduce the probability of sudden or panic changes in the behaviour of financial institutions during a crisis. Capital buffers, for example, allow banks to lend to the private sector even when their losses on previously granted loans are rising and negatively affecting their capital adequacy. Liquidity buffers can prevent panic sales of assets under pressure caused by a need to obtain liquidity quickly to cover deposit withdrawal requests or by investors' unwillingness to roll over short-term bonds issued by banks.

with quarterly information about the results of its macro stress tests of the banking sector. Communication is a very important tool in the systemic risk accumulation phase as well. Although systemic risk was growing to only a relatively limited extent in the Czech Republic in the pre-crisis years, the CNB in its Financial Stability Report 2006 (published in spring 2007) warned against over-optimistic expectations typical of the peak of the business cycle and against risks emerging on the property market.

At present, there is not a complete consensus on what tools can be regarded as *macroprudential policy tools*. Given that a whole spectrum of measures can have macroprudential aspects, a wide range of financial stability measures are usually included in the macroprudential toolkit (see Annex 1).<sup>21</sup> However, it is more appropriate to divide this broad category into macroprudential tools, microprudential tools applied in a macroprudential way, and other financial stability tools. True macroprudential tools are those which can be applied in the form of rules and can therefore take the form of built-in stabilisers (the tools marked in bold in Annex 1). They should automatically limit the procyclicality of the financial system or the risky behaviour of individual institutions.

In addition to true macroprudential tools, *various microprudential regulatory and supervisory tools can be used for macroprudential purposes*.<sup>22</sup> If these tools are applied not to individual institutions, but across the board to all institutions in the system, they can be regarded as macroprudential instruments (the tools marked in italics in Annex 1). Measures of this type, along with *monetary policy tools, fiscal policy tools and tax measures*, have been applied in many countries in the past in an effort to slow excess credit growth (see some of the tools listed in Annex 1). Many of these tools can also be used in a symmetrically opposite manner in a systemic risk materialisation phase in order to preserve access to credit for the private sector as well as at times of greatly increased risk perceptions.

True macroprudential tools in the form of built-in stabilisers, whose introduction is currently the subject of an international debate, are targeted more at the time component of systemic risk. The first set of such tools is aimed at the capitalisation of banks, which by 2018 at the latest should face an obligation to create countercyclical capital surcharges above and beyond the macroprudentially derived minimum capital adequacy ratio to reflect the extent of changing systemic risk over the cycle.<sup>23</sup> According to the agreed version of Basel III, which in future years will be implemented in the Czech Republic via the CRD directive, in good times, when a particular aggregate level of credit in the economy is exceeded, banks will have to start creating a capital buffer that can be used to absorb the negative impacts of future financial instability (Drehmann et al., 2010, or BCBS, 2010). Another set of proposals is directed at ensuring provisioning across the cycle so as to better capture expected credit portfolio losses and force banks to create buffers to cover credit risk.<sup>24</sup> Macroprudential tools of the built-in-stabiliser type but oriented towards the cross-sectional dimension include, for example, capital surcharges set for individual institutions (see the next paragraph). Basel III also includes liquidity indicator compliance requirements, which are also targeted mainly at the cross-sectional dimension (a requirement for a specific ratio of stable sources of balance-sheet liquidity or coverage of potential outflows by highly liquid assets). Margining, i.e. the requirement for a buffer between the value of collateral and the amount which an institution borrows against it, can also be regarded as an instrument fostering the creation of buffers for liquidity risk. This buffer should allow for the absorption of even a large fall in collateral value resulting from a crisis in asset markets. The possibility of configuring liquidity risk management tools so that they have a countercyclical effect is also being discussed.

When using tools oriented towards the cross-sectional dimension of systemic risk, the intermediate target in

21 The ESRB has prepared an internal survey of financial stability tools called the *Yellow Pages*. The regulatory, material and legal aspects of applying each tool are being addressed.

22 Over the past decade, the application of macroprudential tools has been observable mainly in emerging economies (see, for example, CGFS, 2010, or Moreno, 2011). One possible reason is that the existing international regulatory framework applied in advanced economies, including the EU, can put tight constraints on national macroprudential discretion.

23 For more details, see Box 8 and the thematic article *Excessive Credit Growth as an Indicator of Financial (In)Stability and its Use in Macroprudential Policy* (Geršl and Seidler) in this Financial Stability Report.

24 The concepts of this type include the through-the-cycle expected loss model (the European Commission opened a discussion on this proposal in 2009), partially also the expected loss impairment model (a concept advocated since January 2011 jointly by the IASB and the US FSAB) and statistical provisioning (a system applied by the Spanish central bank since 2000). At present, it is not clear whether any of these proposals will be implemented and what approach to provisioning will be applied internationally in the future. Frait and Komárková (2008) present a detailed discussion about procyclical provisioning.

the preventive phase should be to contain the risks that individual financial institutions, markets and instruments can create for the system as a whole. To limit this dimension of risk, associated with interconnectedness, size or significance within the system, it is necessary first to assess the contribution of individual institutions, markets and instruments to systemic risk (see, for example, Tarashev et al., 2010) and then to reduce this contribution or set a limit on it. This should give rise to lower probability of collapse of large, complex or excessively interconnected institutions as a result of credit, market or liquidity risks, greater resilience of institutions, markets and instruments to contagion within the system, and a related overall reduction of loss of confidence in the financial system. The macroprudential tools of the built-in stabiliser type currently under consideration include, for example, systemic surcharges in the form of additional capital or liquidity requirements set for individual institutions taking into account their contribution to systemic risk by dint of their size, complexity and interconnectedness. Several methods for assessing the marginal contribution to systemic risk can be used to determine the size of the systemic surcharge (Bank of England, 2009, Chan-Lau, 2010, or Tarashev et al., 2010). The practical method chosen should reflect the specifics of the financial sector of the country concerned.<sup>25</sup> The point of applying systemic surcharges as a macroprudential policy tool is to inform a specific financial institution about the authorities' assessment of its systemic significance or excessive interconnectedness and thereby give it an incentive to change its structure.

## 8. CONCLUSION

This article set out to open a debate on creating a Czech macroprudential policy framework as a key component of the financial stability policy framework. The macroprudential policy objective is to prevent systemic risk from forming and spreading in the financial system and thereby reduce the probability of occurrence of financial crises with large real output losses for the entire economy. Macroprudential policy should act primarily preventively against signs of financial instability in the future and secondarily to mitigate their impacts if prevention fails. These two main tasks reflect the two phases of evolution of systemic risk – its accumulation

and subsequent potential materialisation. When conducting macroprudential policy it is also vital to respect the fact that systemic risk has two different dimensions. The time dimension is linked with procyclicality in the behaviour of financial institutions and their clients, manifesting itself as financial cycles. The cross-sectional dimension arises as a result of mutual exposures and network linkages between financial institutions. Given the character of the Czech economy and its financial system, the time dimension of systemic risk is identified as being more important and the Czech Republic is advised to prefer a relatively narrow macroprudential policy concept focused primarily on risks associated with the financial cycle. Given also that financial or informational contagion resulting from links between the economy and its institutions and the external environment can be a major source of systemic risk, the macroprudential policy framework must also include the cross-sectional dimension.

Constructing a sophisticated operational framework linking the individual dimensions and development phases of systemic risk with relevant indicators and instruments will be an important condition for efficient and effective implementation of macroprudential policy. When performing the two main tasks mentioned above, macroprudential authorities must focus their attention on forward-looking indicators and simultaneously take into account the potentially high degree of discontinuity in the evolution of systemic risk. To this end, they need to use specific sets of indicators and tools reflecting the different dimensions and phases of systemic risk.

Over the financial cycle it will be necessary, using forward-looking indicators, to catch the moment at which systemic risk starts to accumulate, identify the point at which the tolerable limit for systemic risk has been exceeded, and send out a signal that macroprudential tools need to be activated. If prevention fails, it will be necessary, using a different set of indicators, to determine the point at which a financial instability event has to be declared, assess the potential scale and seriousness of the manifestations of the crisis, and recommend appropriate anti-crisis tools. Forward-looking tools should then ultimately help us to detect when systemic risk has fallen below the critical level and tell us when we can discontinue the anti-crisis measures and support policies.

<sup>25</sup> Given the characteristics of the Czech financial sector, it would make sense to track the size factor rather than the interconnectedness factor when calculating the systemic surcharge, as it is highly likely that any negative externalities for the Czech economy would be linked more with the failure of large financial institutions or with concentration risk (financial institutions hold identical or correlated assets in their balance sheets or finance themselves on identical or correlated markets).

Within the macroprudential policy operational framework there must still be a trigger mechanism for the use of tools in the risk inception and manifestation phase. This mechanism should be relatively complex yet flexible. When implementing such policy, it will be vital to combine a rigorous analytical approach with a large dose of judgement. Although the priority should be to use rules and tools of the built-in stabiliser type, it will be necessary to leave the macroprudential authority considerable room to exercise discretion.

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## ANNEX 1

## FINANCIAL STABILITY INDICATORS AND TOOLS

Phase	Dimension	Indicators	Tools
Risk accumulation	Time	<ul style="list-style-type: none"> <li>debt-to-assets ratio (H,C)</li> <li>debt-to-income ratio (H,C)</li> <li>interest-to-income ratio (H,C)</li> <li>price-to-income ratio (P)</li> <li>loan-to-value ratio (P)</li> <li>price-to-rent ratio (P)</li> <li>market liquidity in the form of market turnover (P)</li> <li>capital adequacy ratio (F)</li> <li>leverage ratio (F)</li> <li>credit spreads and risk premia (F)</li> <li>credit conditions and characteristics of new loans from BLS (F)</li> <li>default rate, NPL rate (F)</li> <li>level of provisions (loan-loss provision rate, coverage ratio, F)</li> <li>credit-to-GDP (deviation from long-term trend or normal)</li> <li>gaps in asset prices and yields (deviations from long-term trend or normal)</li> <li>rate of growth of loans and asset prices</li> <li>early warning systems</li> <li>composite indicators of financial stability or leverage level</li> </ul>	<ul style="list-style-type: none"> <li><b>countercyclical capital buffers</b></li> <li><b>ceiling on leverage ratio*</b></li> <li><b>provisioning trough financial cycle</b></li> <li><b>introduction of "through-the-cycle" elements into risk management models and asset valuation models</b></li> <li><b>countercyclical setting of margins and haircuts for contracts used to raise funding*</b></li> <li><i>increased risk weights for certain types of loans (e.g. loans for residential or commercial property and foreign currency loans)</i></li> <li><i>increased loan loss provisions depending on period in default</i></li> <li><i>ceilings on LTV ratios for loans for house purchase (or increased capital requirements for loans with high LTV ratios)</i></li> <li><i>ceilings on debt-to-income or payment-to-income ratios for household borrowing (or increased capital requirements for loans with high ratios)</i></li> <li><i>increased collateral requirements for loans to corporations</i></li> <li><i>additional reserve requirements in the event of a change in credit dynamics</i></li> <li><i>rules for reference rates for loans for house purchase</i></li> <li>monetary policy tools: interest rates, minimum reserve rates and marginal reserve rates for selected liability sources, foreign exchange market interventions</li> <li>fiscal and tax policy tools: tighter property taxation rules (for second and additional homes), reduction or elimination of tax deductibility of interest on loans for house purchase, introduction of transaction taxes for certain items of capital inflows from abroad, government spending cuts</li> </ul>
	Cross-sectional	<ul style="list-style-type: none"> <li>loans-to-deposits ratio (F)</li> <li>ratio of funds acquired on interbank market (F)</li> <li>maturity transformation ratio (maturity mismatch indicators, customer funding gap, F)</li> <li>composite liquidity index (F)</li> <li>liquidity gap tests (F)</li> <li>indicators of scale of activity within financial system (e.g. flows between institutions, F)</li> <li>degree of asset and liability concentration (F)</li> <li>share of large exposures in balance sheet (F)</li> <li>capital quality structure (F)</li> <li>leverage ratio (F)</li> <li>scale and structure of off-balance-sheet items (F)</li> <li>bank foreign debt to bank foreign asset ratio (net external assets of banks, F)</li> <li>currency mismatch indicators (open foreign exchange position, share of foreign currency loans, F)</li> <li>composite volatility index (M)</li> <li>macroeconomic imbalance indicators (government deficit and government debt, current-account deficit and external debt, national investment position, foreign exchange reserves, external financing requirements, currency under- or over-valuation)</li> </ul>	<ul style="list-style-type: none"> <li><b>capital or liquidity surcharges for size, complexity and interconnectedness</b></li> <li><b>liquidity buffers and requirements for stable balance-sheet liquidity sources</b></li> <li><b>maturity transformation limits (maturity ladders, liquidity coverage ratio)</b></li> <li><i>loan-to-deposits ratio ceilings</i></li> <li><i>changes to margins and haircuts for fundraising contracts</i></li> <li><i>reserve requirements (e.g. for sources in domestic or foreign currency)</i></li> <li><i>leverage limits for financial investors</i></li> <li><i>limits on intra-institution exposures (e.g. between parent and subsidiaries) and interbank exposures</i></li> <li><i>limits on currency mismatches (net open positions, share of net external liabilities)</i></li> <li><i>changes to capital requirements for large exposures*</i></li> <li><i>limits on sector concentration for lending or investment</i></li> <li>increased disclosure of risky positions</li> <li>active communication by authorities regarding changes in risk</li> </ul>

Phase	Dimension	Indicators	Tools
Risk materialisation	Time	<ul style="list-style-type: none"> <li>dynamics of default rate and NPL ratio (F)</li> <li>dynamics of provisioning (coverage ratio, LLPR, F)</li> <li>profitability (F)</li> <li>change in CAR (F)</li> <li>macro stress tests of markets and credit risks (F)</li> <li>credit spreads (H,C,G,M)</li> </ul>	<ul style="list-style-type: none"> <li><b>release of capital and liquidity buffers</b></li> <li>capital injections for selected banks*</li> <li>active communication by authorities to explain extent of problem*</li> <li>disclosure of stress test results*</li> </ul>
	Cross-sectional	<ul style="list-style-type: none"> <li>macro stress tests of liquidity (F)</li> <li>changes in market liquidity measures (M)</li> <li>activity and spreads on interbank money market and government bond market (F)</li> <li>CDS spreads (F)</li> <li>interbank contagion tests (F)</li> <li>CoVaR (F)</li> <li>joint probability of distress (F)</li> <li>contingent claim analysis (F)</li> </ul>	<ul style="list-style-type: none"> <li>easier access to central bank refinancing facilities*</li> <li>activation of contingency funding plans</li> <li>protection of bank creditors (e.g. government guarantees for bank liabilities)*</li> <li>greater or wider deposit insurance</li> <li>programmes to transfer bad assets to bad banks and clean up of balance sheets</li> <li>transparency regarding exposures and risks of individual market segments (e.g. CNB has disclosed extent of exposures to highly indebted governments)</li> <li>communication regarding methods for dealing with illiquid and insolvent institutions</li> <li>living wills</li> </ul>

Note: The table contains a list of selected instruments. Many of these tools can be directed at both the time and cross-sectional component of systemic risk. The table gives the predominant target. Asterisks (\*) denote tools that are also highly relevant to the second dimension. Macroprudential tools of the type of built-in stabilisers are highlighted in bold. Potential macroprudential uses of supervisory and regulatory tools are highlighted in italics. Other financial stability tools are given in normal text. Sector abbreviations: H – households, C – corporations, F – financial institutions, P – property market, M – financial markets, G – government. No abbreviations are shown next to indicators that are valid for the economy as a whole.