SETTING THE COUNTERCYCLICAL CAPITAL BUFFER THROUGHOUT THE FINANCIAL CYCLE

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ABSTRACT
Basel III regulatory framework an important macroprudential instrument: a countercyclical capital buffer. This instrument is designed to reduce the consequences of worsened access of firms and households to banking credit in bad times. This paper proposes the approach to the countercyclical capital buffer using the experience of the Czech National Bank. It describes its decision-making process from assessing the position of the economy in the financial cycle through to setting the buffer rate. The approach that can be labelled discretion guided by multiple-factor analysis builds upon the signals from both individual and composite indicators of financial cycle and systemic risk. The paper then describes the factors that the macroprudential authority takes into account when setting the specific countercyclical capital buffer rate.

Keywords: *countercyclical capital buffer, credit-to-GDP gap, credit losses, financial cycle*

1 INTRODUCTION

The countercyclical capital buffer (CCyB) is a pure macroprudential policy tool. It is designed to protect the banking sector against risks arising from its behaviour through the financial cycle, and in particular from excessive credit growth, which generates systemic risks and increases the potential for sharp swings in economic activity. A macroprudential policy authority should ensure that banks create a capital buffer during the financial expansion to enable them to absorb losses in the event of an adverse shock accompanied by elevated financial stress and growth in loan defaults. Use of the buffer at such a time should prevent a fall in the supply of credit to the sound part of the economy and stop the shock spreading from the financial sector to the real economy and causing the banking sector further losses.

At first glance, the CCyB is a very simple tool. In reality, though, setting the CCyB rate is a complex task in terms of both decision-making and communication. It can be particularly difficult to justify the specific level at which it is set. This paper aims to present key aspects of the CNB's approach to setting the CCyB rate, contribute to better formation of

[1] The views presented are those of the authors and not necessarily those of the Czech National Bank. Jan Frait acknowledges support from the Grant Agency of the Czech Republic (project no. 16-21506S).

expectations about the future path of the rate and thereby facilitate capital planning for credit institutions. The paper is structured as follows. Section 2 summarises the essence and purpose of the CCyB, describes the BCBS/ESRB methodology and points out some issues with its application to the Czech economy. Section 3 introduces the main indicators used to determine the position of the economy in the financial cycle. Section 4 details the CNB's approach to setting the buffer rate and discusses its decision-making process, which draws on stress test results and known facts about the morphology of the financial cycle. The section 5 concludes.

2 THE COUNTERCYCLICAL CAPITAL BUFFER ESSENCE AND THE BCBS/ESRB METHODOLOGY

The recent financial crisis revealed that stress in the financial sector can easily spread to other sectors of the economy. Faced with capital shortages due to losses, banks in some countries severely curtailed the supply of credit even to sound non-financial corporations (a situation generally referred to as a "credit crunch"). In response to these funding constraints, some firms had to cut their production substantially. This led to rising unemployment, falling household incomes and, in turn, to a deepening recession. Inadequate capital creation by banks in the upward phase of the financial cycle was thus reflected in a downward spiral where falling aggregate demand due to difficulties in raising funds for viable projects led to further credit losses and further lending constraints. In some countries, public money had to be used to resolve the crisis in the banking sector. This was reflected in growth in long-term interest rates and also adversely affected the real economy.

To avoid a repeat of the spill-over effects of such shocks from the financial sector to the real economy, a countercyclical capital buffer (CCyB) has been incorporated into the macroprudential policy toolkit (BCBS, 2010). The CCyB is aimed at "protecting" banks against excessive impacts of the financial cycle, which banks themselves are involved in creating. In the spirit of this regulation, banks are meant to set aside a sufficient buffer in good times – characterised by rapid credit growth accompanied by relaxation of credit standards and growth in property prices – to cover losses arising from the switch to the downward phase of the financial cycle.

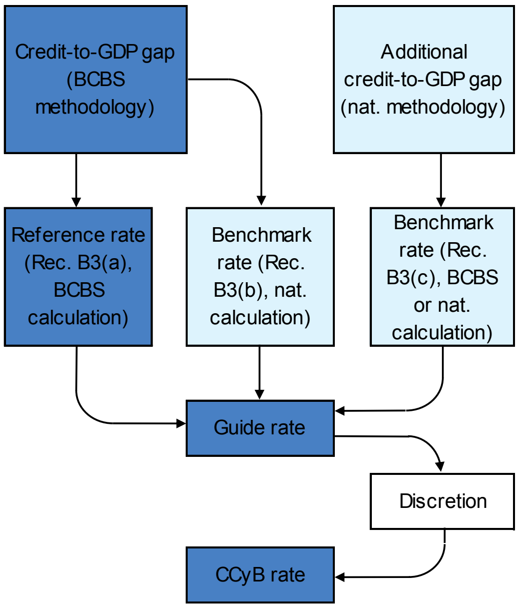
The buffer should be released when risk materialises, so banks should be able to apply a reduced capital requirement to maintain the supply of credit to the sound part of the real economy. As adverse shocks can occur unexpectedly, the macroprudential authority can set a new CCyB rate with immediate effect when deciding to release the buffer. The addition of a CCyB rate to the overall capital requirement may help tame credit growth in the expansion phase of the financial cycle; however, this can be regarded only as a positive side-effect of the CCyB and is not the main purpose of creating the buffer.[2] The primary objective is still to boost the banking sector's resilience to adverse shocks at times of financial instability and to ensure smooth funding of the real economy through the financial cycle.

The CCyB is a new macroprudential tool and there is limited experience with its use so far. A universally shared approach to the introduction of non-zero CCyB rates and the setting of their specific level has yet to emerge in the international regulatory community. Some macroprudential authorities view the CCyB as a tool that should only be applied in a strongly

[2] There is no clear consensus across the economic community on whether the creation of a capital buffer will give rise to a reduction in the supply of credit by banks. Financial sector representatives often assert that higher capital requirements lead to a decrease in the supply of loans (see Admati et al., 2011). Based on an analysis of data for advanced countries, however, Gambacorta and Shin (2016) find that better capitalised banks have lower funding costs and are capable – especially in worse times – of lending more to the economy than banks with lower capitalisations. For that reason, efforts to constrain credit growth should not be the main motivating factor in CCyB rate decisions.

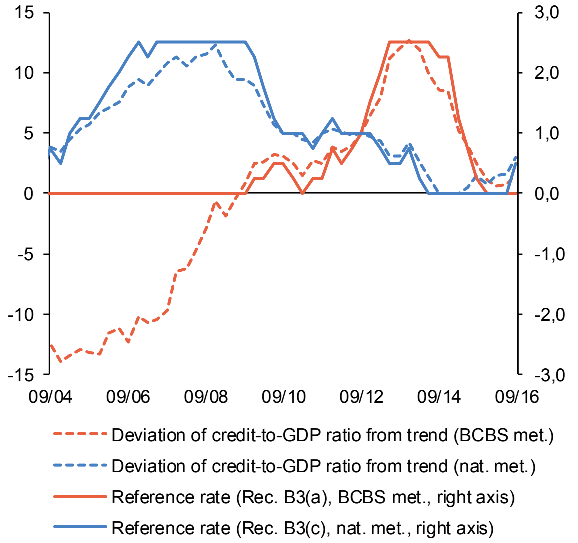
expansionary phase of the financial cycle when systemic risks are already clearly visible. Other macroprudential authorities prefer a more prudent approach in which the CCyB should be created right at the start of a credit recovery or at a certain level even in the neutral phase of the cycle. Five countries in the European Economic Area had set non-zero CCyB rates by November 2017 (ranging from 0.5 to 2.0%).

The basic framework for applying the CCyB was formulated by the Basel Committee on Banking Supervision (BCBS) and subsequently introduced into EU regulatory practice through the CRD IV directive and its transposition into the Member States' national legislation. The European Systemic Risk Board (ESRB) further developed the core principles of the original framework in the form of a recommendation (ESRB, 2014). From the operational macroprudential policy-making perspective, though, the BCBS/ESRB methodology still represents only a very rough guide to when to introduce a buffer rate and what rate to set. For this reason, it needs to be further elaborated and tailored to the specifics of each national financial sector.



Note: Dark blue boxes indicate mandatory elements and light blue boxes voluntary elements of the ESRB (2014) methodology for setting the CCyB rate.

Figure 1: The logic of the BCBS/ESRB regulatory framework for setting the CCyB rate (BCBS, 2010, ESRB, 2014)



(deviation in pp; right axis: rate in % of RWA)

Note: The trend in the BCBS methodology is estimated using the HP filter, lambda = 400,000. The trend in the national methodology is estimated by analysis of local extremes.

Chart 1: The credit-to-GDP gap and the hypothetical CCyB rate under the national and BCBS methodologies (CNB)

The BCBS/ESRB methodology can be summarised into four main steps (see the dark blue boxes in Figure 1). The first involves determining the deviation of the credit-to-GDP ratio from its long-term trend using the Hodrick-Prescott (HP) filter and then using that gap to set a so-called benchmark buffer rate. In the BCBS/ESRB methodology, this rate serves as a guide for setting the CCyB rate.[3] EU Member States are required publish a credit-to-GDP gap and a

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[3] Total credit comprises total loans to the private non-financial sector (households, non-financial corporations and non-profit institutions serving households) plus debt securities issued. The recommended smoothing parameter for the HP filter, λ, is 400,000. The benchmark buffer rate is 0% of risk-weighted assets if the gap is less than or equal to 2 pp and is greater than zero if the gap is larger than 2 pp. The equation used to calculate the rate on the basis of the gaps is: benchmark buffer rate = 0.3125*(gap) – 0.625. The benchmark buffer rate is

benchmark buffer rate quarterly every time they set a CCyB rate. However, they are given discretion to calculate the CCyB guide rate using a different method not necessarily based on the BCBS methodology (see the light blue boxes in Figure 1).

This discretion is allowed because the original BCBS methodology would produce incorrect recommendations in many countries if applied mechanically (see, for example, Geršl and Seidler, 2011). This is true for the Czech Republic, where the use of this methodology would have implied a significantly non-zero benchmark buffer rate as from 2011 Q2 and the maximum rate of 2.5% in 2013 Q2 (see the solid red line in Chart 1). During 2013, however, loans recorded only weak growth, property prices continued to fall in year-on-year terms (as they had done since 2009 Q1) and credit standards were tightened further. These conditions can hardly be interpreted as an expansion phase of the financial cycle.

The main sources of the misleading results of applying the BCBS/ESRB methodology in the Czech economy are a structural break in the time series related to the 1990s banking crisis, when bad loans were written off from banks' balance sheets, and the existence of a specific trend typical of converging economies. The ESRB (2014) recommendation takes such cases into consideration and allows the gap calculation to be tailored partially to the specifics of the national economy. In line with this, the CNB calculates additional gaps that may be more appropriate for macroprudential decision-making. One of these is a credit-to-GDP gap based on a shorter time series excluding the structural break that occurred in the 1990s. Another is based on the ratio of bank loans to GDP and disregards other sources of credit financing (unlike the BCBS/ESRB methodology). Restricting the calculation to bank loans is logical since the CCyB is a tool targeted at the banking sector and at ensuring stable bank lending.

In addition to gaps calculated using the HP filter, the authority can apply an alternative method for determining the deviation from the trend which eliminates some of the known issues with the said filtration technique. This method is based on analysis of local extremes[4] in the time series. This eliminates the problem of the removal of old loans from banks' balance sheets after the late-1990s crisis and (unlike the HP filter) does not lead to changes in the trend estimate as new observations come in. The corresponding gap (referred to as the expansionary credit gap) is very different from the original signal and much closer to the true course of the financial cycle (see the solid blue line in Chart 1).

Regardless of the estimation technique, however, the credit-to-GDP gap is just an initial guide to the position of the economy in the financial cycle. The credit-to-GDP ratio is only a very rough measure of leverage in the economy, on the basis of which it is hard to identify turning points between phases of the financial cycle in a timely manner (for more details, see Frait and Komárková, 2012, pp. 14 and 22).

3 KEY INDICATORS

For the reasons given in the previous section, the recommendation of the ESRB (2014) requires national authorities to take into account other variables indicating excessive credit growth and the build-up of system-wide risk when setting the CCyB rate. To this end, the CNB uses the following set of indicators, which are assessed in section 4.2 of this Report.

The composite financial cycle indicator (FCI, Plašil et al., 2016) plays an important role in determining the position of the economy in the financial cycle. The FCI was created in order

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2.5% if the gap is greater than or equal to 10 pp. The resulting benchmark buffer rate should be calibrated in steps of 0.25 pp or multiples thereof.

[4] To reveal extremes indicating credit expansion, the CNB uses the difference between the present value of the ratio and the minimum value achieved in the past eight quarters. Other time periods were tested but the results remained robust. This analysis is loosely inspired by the definition of the cycle proposed in Burns and Mitchell (1946) and by the unemployment recession gap (Stock and Watson, 2010).

to measure the accumulation of risks in the financial sector and to provide an early warning (6–8 quarters ahead) signal of the potential materialisation of such risks (see Chart 2). The FCI includes indicators covering a wide range of demand and supply factors which, according to earlier studies and expert judgement, well characterise the cyclical swings in financial risk perceptions.[5] Decomposing the FCI into individual factors allows the CNB to identify the determinants of the current evolution of the composite indicator and, where relevant, helps it choose the optimal macroprudential response.

When determining the position in the financial cycle, the CNB also pays increased attention to the dynamics of bank loans with respect to both the stock (overall amounts) and flows (new business) of credit. The dynamics of the stock of loans provide information on the evolution of overall leverage, while the dynamics of new loans indicate current tendencies in risk-taking by households and non-financial corporations.

In addition to credit dynamics, the CNB focuses on other areas linked closely with lending, most notably the property market and the potential for a spiral between property price growth and growth in house purchase loans. Rising property prices can give the impression that the financial benefits of buying a house are increasing and can thus motivate other households to buy property financed by mortgage loans. Besides the annual rate of growth of property prices, the CNB tracks measures of overvaluation and sustainability relative to economic fundamentals (e.g. the price-to-annual wage ratio, the price-to-income ratio and other indicators presented in more detail in Hlaváček and Hejlová, 2015).

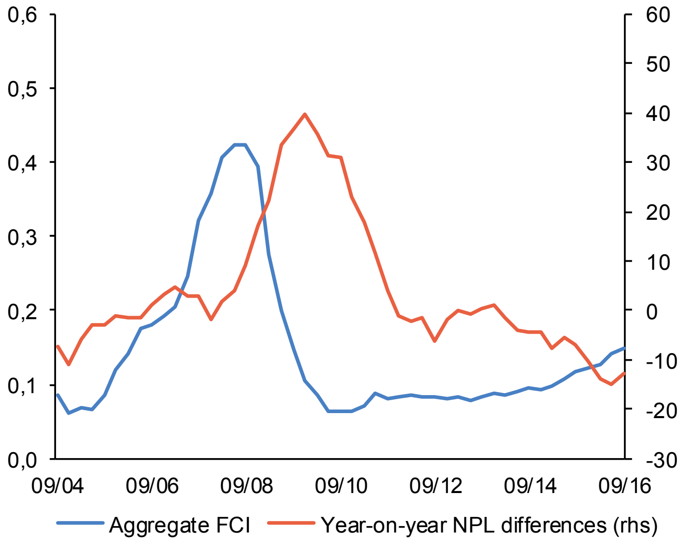

Chart 2: The composite FCI and risk materialisation (CNB)

4 DECIDING UPON THE CCYB RATE

The CCyB rate decision-making process is largely formalised and has clearly defined rules. For the reasons described in detail in section 2, however, the CCyB rate cannot be set in a purely mechanical fashion. The CNB's approach is thus one of "guided discretion", requiring,

[5] The indicators are credit growth, property prices, lending conditions, sustainability of the debt of non-financial corporations and households, asset prices and the adjusted current account deficit-to-GDP ratio. The IFC takes into account the changing cross-correlation structure and takes its highest values at times of rising synchronisation between all the input signals. The weights of the variables in the composite indicator are calibrated so that the indicator best predicts the loan impairment losses observed in the Czech banking sector (i.e. the risk materialisation phase).

in addition to regular assessment of the main indicators, a great deal of expert judgement on developments in the financial sector. The entire process is illustrated in simplified form in Figure 2. In the initial phase, the CNB needs to judge whether the current CCyB rate is commensurate with the observed situation (the blue area in Figure 2). The CNB thus has to decide whether conditions in the economy necessitate the introduction of a non-zero rate and, if so, whether a tightening or easing of macroprudential policy is needed. This phase of the process is based on the CNB's assessment of the position of the economy in the financial cycle as well as other aspects such as the settings of other CNB tools whose effects might partially overlap with those of a non-zero rate. Given the complexity of the financial cycle, expert judgement is a necessary part of our considerations about the appropriateness of the current CCyB rate.

If the CNB concludes that the current CCyB rate is appropriate, it can confirm it at the current level. If, however, it feels that economic conditions call for a rate adjustment, be it a tightening or an easing, it moves to considering a change in the CCyB rate (the red area in Figure 2).[6] The aspects taken into account when changing the rate are described in more detail below in this section. Before the final decision is made, expert judgement enters the process once again, and the new CCyB rate is then set on the basis of all the available information (the yellow area in Figure 2).

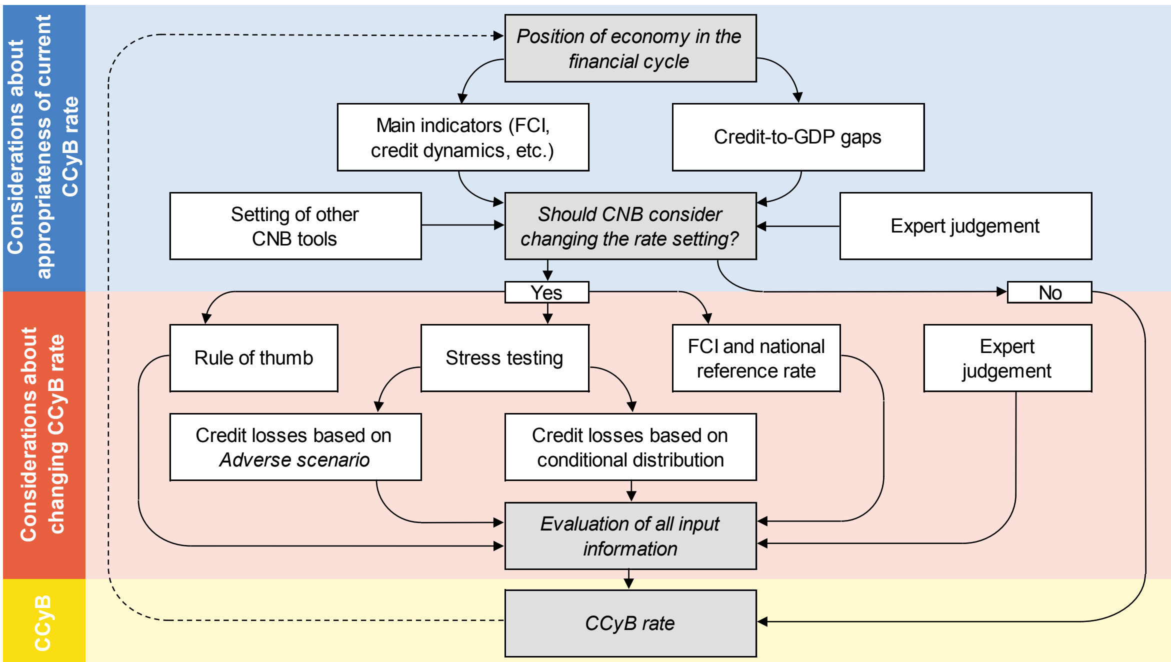

Figure 2: The CNB's approach to setting the CCyB rate (CNB)

Where application of the BCBS/ESRB methodology is not a suitable starting point for determining the rate (see above), other criteria must be taken into account in the decision-making process. The simplest guide for setting the rate is past historical experience and the known facts about the morphology of the financial cycle. The economic literature states that the average length of the financial cycle in advanced countries is around 15 years. The

[6] CCyB rate decision-making here primarily refers to gradually increasing or decreasing the rate. The decision-making process on cancelling a non-zero rate in order to release the buffer can take the form of a rapid reaction to an unexpected shock or an event generating a risk to financial stability (see Figure 7 in Frait and Komárková, 2012, p. 22).

downward phase from the peak to the trough of the cycle is around half as long as the upward phase from the trough to the next peak (see, for example, Drehmann et al., 2012, 2013). Moreover, the upward phase can be divided into a recovery phase, when the subdued economy slowly emerges from the trough of the cycle, and an expansion phase, when credit dynamics surge and systemic risk rises. The two phases are roughly equal in length (see Drehman et al., 2012). On a general level, then, the observed historical experience implies that the economy is in the expansion phase of the financial cycle for around five years on average. When there is a need to build up the CCyB during an expansion phase, a simple rule of thumb based on the ratio of the assumed maximum rate (2.5%) to the assumed length of the expansion phase (five years) can be used. This rule therefore states that the macroprudential authority should increase the CCyB rate by at least 0.5 pp in each year of the expansion phase. Despite being only a rule of thumb, this can be a useful guide for setting the rate given the difficulty of predicting a turning point in the financial cycle at a time when most indicators are not sending out negative signals.

Table 1: The indicative relationship between the FCI values and the CCyB rate (CNB calculations)

FCI values		CCyB rate
from	to	
0,00	0,09	0,00 %
0,09	0,11	0,25 %
0,11	0,13	0,50 %
0,13	0,16	0,75 %
0,16	0,19	1,00 %
0,19	0,23	1,25 %
0,23	0,27	1,50 %
0,27	0,32	1,75 %
0,32	0,37	2,00 %
0,37	0,43	2,25 %
0,42	1,00	2,50 %

Note: The financial expansion observed in the Czech economy just before the global financial crisis started was so strong that it would have necessitated setting the rate at least at the "upper limit" of 2.5% had the tool been available. For this reason, the historical maximum of the FCI is associated with a CCyB rate of 2.5%. The input data are normalised for the FCI calculation, so the historical FCI values constantly change as new data come in.

Note: The table is drawn up on the assumption that the CCyB rate would have been 2.5% during the last crisis. The input data are normalised for the FCI calculation. For this reason, the historical FCI values constantly change as new data come in.

Another rough guide is based on the specific historical experience of the Czech banking sector and on domestic indicators of the financial cycle. On the one hand, the CNB can use the national credit-to-GDP gap and the rate implied by it (see Chart 1). On the other hand, our considerations about the level of the rate can be based on the composite FCI (see section 3 for more details).

Table 1 shows the indicative relationship between the FCI values and the CCyB rate. The presented relationship can be formally derived by adopting a set of assumptions, two of which exert a decisive influence on it. The first is that the maximum observed FCI value from the peak of the previous cycle in mid-2008 must correspond to a rate of 2.5%. The second is that the median of the sub-indicators entering the FCI calculation corresponds to a kind of "equilibrium" situation where the financial cycle is neither significantly subdued nor overheating. The FCI is constructed using a quadratic system of weights (for more details, see Plašil et al., 2016), so the relationship between the FCI values and the CCyB rate is non-linear. A consequence of this property is that the bands of FCI values are not necessarily of the same width for all the rates, and it does not hold that an increase in the FCI values leads to a proportional change in the rate.

More formal approaches to setting the CCyB rate are based on the idea that the size of the CCyB should ensure that the total capital buffers are consistent with the potential losses that the banking sector as a whole may be exposed to in the event of future stress. A natural way of doing this is to link CCyB rate decision-making with bank stress testing. The crudest option is to compare the overall impact of the adverse shock with the sum of the capital conservation buffer (CCoB) and the CCyB. If the CCoB and the CCyB are not capable of absorbing the simulated decrease in capital at the sector level in the *Adverse Scenario*, the macroprudential authority may consider raising the CCyB rate to the level at which the capital buffers would be able to absorb it fully. The impact of the adverse scenarios in the CNB's macro-stress tests has fluctuated around 5 pp of the banking sector's capital ratio in recent years. If this rule were applied purely mechanically, this impact would imply a rate of 2.5% for both buffers. However, this is too crude an approach, among other things because it does not take into account the banks' own prudent approach (e.g. provisioning). A more sensitive option is to compare the credit losses in the *Adverse Scenario* with the expected losses in the *Baseline Scenario*.

The point of the *Adverse Scenario* is to test the resilience of the banking sector to an exceptionally large and implausible stress. One could therefore argue that considerations about the CCyB rate should take into account the fact that the probability of such situations occurring varies across the phases of the financial cycle. For example, the probability of a crisis is much higher in a strongly expansionary phase of the cycle than when the subdued economy is just starting to recover. An estimate of the conditional credit loss probability distribution can be used for this purpose. In the case of the conditional distribution, the potential size of the losses (the variance and shape of the distribution) differs depending on the current phase of the cycle. In simplified terms, the risk of a crisis – and hence also the probability of greater cumulative losses in future – steadily increases as the economy moves into the expansion phase of the cycle. To ensure consistency with the most likely outcome, the conditional distribution is constructed in such a way that the expected size of the losses (the expected value of the distribution) always matches the losses in the *Baseline Scenario*.

Owing to the complexity of stress testing, the conditional loss distribution cannot be derived mathematically and must be estimated using simulation techniques. The principle consists in simulating a large number of alternative paths for the stress test input variables and calculating the corresponding cumulative losses for each of them. An empirical estimate of the probability distribution is then obtained by summarising the losses simulated in this way. The technique for generating the alternative paths is based on the maximum entropy bootstrap method (see Vinod, 2006).[7] The size of the deviation of the simulated paths from the *Baseline*

[7] Unlike traditional bootstrap techniques, this method preserves the cyclical properties of the time series and is also suitable for directly simulating non-stationary series. A total of 1,000 bootstrap simulations with a time period of 12 quarters were performed for variables including PD, LGD and growth in bank loans for the sectors of non-financial corporations and households. The LGD values in the simulation are limited as follows: (i) non-

Scenario projection can be regulated by changing the settings of the input parameters of the chosen method. The degree of deviation is set by the CNB depending on the current phase of the financial cycle. The specific values of the time-varying parameters are obtained by solving an optimisation problem taking into account, among other things, the size of the past differences between the losses in the *Baseline Scenario* and the actual losses.

When deciding on the rate, the macroprudential authority can then choose its own level of sensitivity to unexpected events. Like most macroprudential and supervisory authorities in other advanced countries, the CNB prefers a prudential approach, i.e. it tries to ensure that there are sufficient buffers in place to cover even relatively unlikely credit losses. This corresponds to the 99% quantile of the probability distribution.

The need to raise the rate is naturally lower in the case of a less strict approach to setting macroprudential tools. For example, if the 60% quantile were used, the difference would be around CZK 7 billion and a CCyB rate of 0.5% would be sufficient to cover this level of credit losses. The relationship between the final rate decision and the stress test results is not entirely mechanical, but it does represent a logical enhancement of the forward-looking principle of macroprudential policy. This approach to applying stress test results to assess whether capital requirements are adequate is also being discussed in the context of the planned EBA guidelines on bank stress testing (EBA, 2015).

Deciding on the CCyB rate setting is not mechanically based on the aforementioned approaches. Instead, it reflects a complex evaluation of systemic risks.

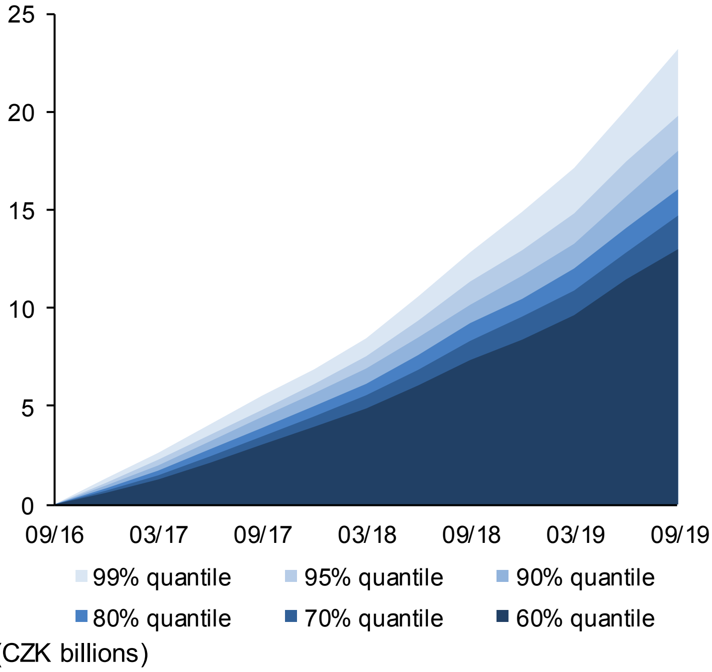

Chart 3: The difference between expected credit losses and alternative quantiles of the credit loss probability distribution (CNB calculations)

5 CONCLUSION

The decision-making process regarding the CCyB rate contains both systematic elements and expert judgement and takes the form of guided discretion. The first step is to assess the position of the economy in the financial cycle. Then the decision-making on the specific level

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financial corporations: 0.45–0.55; (ii) households – loans for house purchase: 0.2–0.3; (iii) households – consumer credit: 0.55–0.65.

of the CCyB rate has to take into account a wide range of factors, which, in addition to an assessment of the main indicators of the financial cycle, include stress test results and stylised facts about the financial cycle Such approach can be labelled discretion guided by multiple-factor analysis. Putting more weight on formal approaches can only be expected in the future dependent on the accomplishments of research in modelling the financial cycle. It is a major challenge for future research in the area.

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