

The countercyclical capital buffer in Germany

Analytical framework for the assessment of an appropriate domestic buffer rate

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Summary

The purpose of this publication by the Deutsche Bundesbank is to provide information about the Countercyclical Capital Buffer (CCB), a new tool for macroprudential regulation.

The CCB is a surcharge on banks' common equity Tier 1 capital that can be varied over the credit cycle. During periods of excess aggregate credit growth, the supervisory authority may levy a CCB which it can later release. When times are good, therefore, banks will build up a capital cushion that they can use during bad times to absorb losses. The purpose of the CCB is to make the banking sector more resilient.

This publication introduces the methodological basis for assessing an appropriate CCB rate in Germany. Aside from this domestic CCB rate, the institutions may face additional CCB requirements for their foreign credit exposures if the competent foreign authorities levy a CCB. The methodology for the domestic CCB rate set out here implements statutory requirements and also complies with the European Systemic Risk Board's recommendation on setting the CCB rate (ESRB, 2014). It also takes into account the specific circumstances in Germany, as well as any limitations regarding data availability and quality.

The credit-to-GDP gap plays an important role in setting the CCB rate. It shows to what extent loans historically grow faster than economic output. A large positive gap may be an indicator of excessive credit expansion.

Overall, the CCB regime follows the principle of "guided discretion". The rule-based component is the so-called buffer guide, which is calculated from the credit-to-GDP gap using a simple conversion formula. However, the CCB rate is not automatically set equal to the buffer guide, but rather results from an overall assessment of systemic risks including the analysis of a number of supporting indicators. Hence, the decision also includes discretionary elements.

In addition to the standardised approach for calculating the credit-to-GDP gap and the buffer guide set out by the Basel Committee on Banking Supervision (BCBS, 2010b), a national method may also be applied. A thorough analysis of the data indicates that this option should be chosen in Germany.

The German national method stipulates two modifications of the Basel definition. First, it applies a narrower definition of credit. The reason is that the relevant data for Germany are available in a consistent form for a significantly longer period of time than the data for the standardised method. The second modification ensures that the buffer guide will not increase further during a period of declining GDP. In order to increase robustness of the CCB decisions, the results obtained under the national method will also be compared with the standardised credit-to-GDP gap and the buffer guide.

For setting the CCB rate, it is advisable to include a series of supporting indicators (table below). These will help to decide (i) whether credit growth is excessive, (ii) whether a correction of the abnormal development is likely, (iii) how resilient the private non-financial sector and the banks are, and (iv) how high the level of stress in the financial system is.

Buffer rate decisions should be transparent and comprehensible to the public in order to increase the effectiveness of the CCB. For this purpose, the Bundesbank publishes this analytical framework in line with the macroprudential strategy adopted by the German Financial Stability Committee (*Ausschuss für Finanzstabilität*: AFS) and the ESRB recommendation. This framework will be reviewed and updated, as necessary.

Summary

Categories	Indicators
Rule-based component	<ul style="list-style-type: none"> • Standardised credit-to-GDP gap and buffer guide (based on a broad credit definition: total debt) • National credit-to-GDP gap and buffer guide (based on a narrower credit definition: bank credit)
Bank credit and total debt	<ul style="list-style-type: none"> • Credit-to-GDP ratio (total debt) • Credit-to-GDP ratio (bank credit) • Real growth in total debt • Real growth in bank credit • Real growth in bank credit (HHs) • Real growth in bank credit (NFCs) • Net interest spread
Real estate market	<ul style="list-style-type: none"> • Growth in residential real estate prices • Real growth in housing loans • Lending standards for housing loans
External imbalances	<ul style="list-style-type: none"> • Current account balance as a percentage of GDP
Mispricing of risks	<ul style="list-style-type: none"> • Real long-term interest rate • DAX 30 price index • VDAX volatility index • Spread on corporate bond yields
Private sector debt burden	<ul style="list-style-type: none"> • Debt service ratio (HHs) • Debt service ratio (NFCs)
Soundness of banks	<ul style="list-style-type: none"> • Tier 1 capital ratio • Unweighted capital ratio • Non-performing loans • Loans with increased default risk
Stress in the financial system	<ul style="list-style-type: none"> • Stress indicator for the German financial system • EURIBOR-OIS spread • Average CDS spread for German banks

Note: MFIs denotes monetary financial institutions; HHs denotes households; NFCs denotes non-financial corporations.

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Abbreviations

AFS	Financial Stability Committee (<u>A</u> usschuss für <u>F</u> inanz <u>s</u> tabilität)
BaFin	Federal Financial Supervisory Authority (<u>B</u> undes <u>a</u> nstalt für <u>F</u> inanzdienstleistungsaufsicht)
BCBS	<u>B</u> asel <u>C</u> ommittee on <u>B</u> anking <u>S</u> upervision
BIS	<u>B</u> ank for <u>I</u> nternational <u>S</u> ettlements
CCB	<u>C</u> ountercyclical <u>C</u> apital <u>B</u> uffer
CDS	<u>C</u> redit <u>D</u> efault <u>S</u> wap
CISS	<u>C</u> omposite <u>I</u> ndicator of <u>S</u> ystemic <u>S</u> tress
CRD IV	<u>C</u> apital <u>R</u> equirements <u>D</u> irective IV
DAX	German share index (<u>D</u> eutscher <u>A</u> ktien <u>i</u> ndex)
DSR	<u>D</u> ebt <u>S</u> ervice <u>R</u> atio
ECB	<u>E</u> uropean <u>C</u> entral <u>B</u> ank
EMU	<u>E</u> uropean <u>M</u> onetary <u>U</u> nion
ESA	<u>E</u> uropean <u>s</u> ystem of national and regional <u>a</u> ccounts
ESRB	<u>E</u> uropean <u>S</u> ystemic <u>R</u> isk <u>B</u> oard
EU	<u>E</u> uropean <u>U</u> nion
EURIBOR	<u>E</u> uro <u>I</u> nter <u>b</u> ank <u>O</u> ffered <u>R</u> ate
GDP	<u>G</u> ross <u>d</u> omestic <u>p</u> roduct
HHs	<u>H</u> ouse <u>h</u> olds
HP filter	<u>H</u> odrick- <u>P</u> rescott filter
IMF	<u>I</u> nternational <u>M</u> onetary <u>F</u> und
KWG	German Banking Act (<u>K</u> redit <u>w</u> eseng <u>e</u> setz)
MFI	<u>M</u> onetary <u>F</u> inancial <u>I</u> nstitutions
NFCs	Private <u>n</u> on- <u>f</u> inancial <u>c</u> orporations
OIS	<u>O</u> vernight <u>I</u> ndex <u>S</u> wap
PP	<u>P</u> ercentage <u>p</u> oints
RWAs	<u>R</u> isk- <u>w</u> eighted <u>a</u> ssets
SolvV	German Solvency Regulation (<u>S</u> olvabilitäts <u>v</u> erordnung)
SSM	<u>S</u> ingle <u>S</u> upervisory <u>M</u> echanism
VDAX	<u>V</u> olatility index for <u>D</u> A <u>X</u>

Introduction

1 Introduction¹

The Countercyclical Capital Buffer (CCB) is a new instrument of macroprudential regulation. The CCB is a surcharge on the banks' common equity Tier 1 capital,² the amount of which depends on the credit cycle. The supervisory authority may establish a positive CCB rate if the aggregate domestic credit growth is excessive. Once the credit growth has returned to normal or the banks suffer losses, the CCB rate can be decreased to as far as zero. The CCB therefore provides banks with an additional capital buffer for difficult times. That will strengthen the resilience of the banking system throughout the credit cycle.

In Germany, the CCB will be set as from 1 January 2016. It is based on the Basel III framework³ and was implemented in the EU through CRD IV.⁴ The CCB was incorporated into German law via the German Banking Act (*Kreditwesengesetz*: KWG) and the German Solvency Regulation (*Solvabilitätsverordnung*: SolvV). In addition, the European Systemic Risk Board has published a recommendation on guidance for setting the CCB rates (ESRB, 2014).

This document sets out the analytical framework of the CCB. In particular, it describes how to assess an appropriate CCB rate in Germany. This methodology implements the requirements of the KWG and the SolvV and closely follows the ESRB recommendation, making some necessary adjustments related mainly to data issues.⁵ Since the transparency of the methodology is decisive for making the CCB regime credible and effective, the Bundesbank publishes this analytical framework.

The starting point for the analysis is the credit-to-GDP gap. It shows how the ratio of the aggregate credit amount to gross domestic product deviates from its long-term trend. A large positive gap may indicate excessive credit growth.⁶ The credit-to-GDP gap is the basis for calculating the so-called buffer guide, which in turn delivers an indication for the appropriate CCB level. However, the CCB is not simply set equal to the buffer guide. Instead, **additional supporting indicators** are reviewed and the CCB rate is determined as the result of an **overall assessment** of risks.

This document is structured as follows. Section 2 introduces the conceptual fundamentals. Section 3 explains the indicator selection process. Section 4 describes the credit-to-GDP gap and the supporting indicators. Section 5 contains some final remarks. In addition, the document includes two annexes. Annex A reviews the most important indicator – the credit-to-GDP gap. Annex B describes how to calculate the indicators and the data used.

¹ With contributions from Michael Richter and Benjamin Weigert and support, especially on data issues, from Nataliya Barasinska, Andreas Dietrich, Robert Düll, Cihan Duran, Philipp Haenle, Reiner Mahr, Jens Mehrhoff, Manuel Rupperecht, Mirko Schäfer, Alexander Schmidt, Alexander Schulz, Stefan Thum, Elena Triebkorn, Holger Weigand, Matthias Weiß, Johannes-Gabriel Werner and Kathleen Zeppin.

² The terms "(credit) institution" and "bank" are used synonymously in this document and refer to institutions within the meaning of article 1 (1b) of the German Banking Act (*Kreditwesengesetz*: KWG).

³ BCBS (2010a and 2010b).

⁴ CRD IV denotes the Capital Requirements Directive IV: Directive 2013/36/EU of the European Parliament and of the Council, Corrigendum of 27 June 2013.

⁵ See article 136 (2) CRD IV and article 33 (1), sentence 2 SolvV.

⁶ See, in particular, recitals no. 80 and no. 82 and article 136 (2) CRD IV, article 10d (3), sentence 3 KWG and article 33 (1), sentences 1 to 3 SolvV.

Conceptual considerations

2 Conceptual considerations

2.1 Purpose and design of the CCB

The aim of the CCB is to make the banking sector more resilient in the face of systemic risks⁷ associated with the credit cycle.⁸ For use of the CCB, only the aggregate credit to the private non-financial sector is relevant.⁹ The CCB should be activated if credit growth in this sector shows signs of overheating (for an explanation, see section 3.1).

During a system-wide stress phase, banks can use the CCB to absorb losses.¹⁰ In this way, the CCB can help to prevent banks from unduly restricting the supply of credit during times of stress, which might otherwise hinder a cyclical recovery. This is important because recessions connected with stress in the banking system are often more severe than normal economic downturns.¹¹ If no stress situation materialises, the supervisory authority will gradually lower the buffer rate again, but only once credit growth has returned to normal and the risks to stability have diminished.

In Germany, the Federal Financial Supervisory Authority (*Bundesanstalt für Finanzdienstleistungsaufsicht*: BaFin) is responsible for setting and publishing the domestic buffer rate on a quarterly basis. The Bundesbank supports BaFin by preparing analyses as to the appropriate buffer rate based on the methodological framework set out in this document.¹² When setting the buffer rate, BaFin also considers any recommendations by the ESRB and the German Financial Stability Committee (*Ausschuss für Finanzstabilität*: AFS).¹³ Moreover, BaFin cooperates with the European Central Bank (ECB) as part of the Single Supervisory Mechanism (SSM).¹⁴ The buffer rate set by BaFin applies to the relevant German credit exposure¹⁵ of domestic and foreign banks. The CCB rate normally falls into the interval between 0 % and 2.5 % and may vary in steps of 25 basis points or a multiple thereof. If necessary, a buffer rate greater than 2.5 % may also be set.¹⁶

Every bank will calculate the institution-specific CCB rate that it must apply depending on its domestic and foreign credit exposure. The institution-specific CCB rate is equal to

⁷ Systemic risks are defined as the possible adverse effects on the real economy of malfunctions across essential parts of the financial system; see AFS (2014, p. 47). Excessive aggregate credit growth often leads to a build-up of systemic risks that may materialise in the form of a financial crisis; see Kaminsky et al. (1998) and Kaminsky and Reinhart (1999).

⁸ See BCBS (2010b, p. 1).

⁹ Here, interbank loans are not considered. Contagion via the interbank market can cause systemic risks. Other tools – such as capital buffers for (globally and otherwise) systemically important institutions – can address this structural aspect of systemic risks in a more targeted manner than the CCB; see BCBS (2010b, p. 11).

¹⁰ In general, institutions may also use the buffer even without a buffer release by the supervisory authority. However, in such cases they are subject to restrictions, in particular regarding the distribution of profits (article 10i KWG; article 37 SolvV).

¹¹ See, e.g., Jordà et al. (2011, 2013), Claessens et al. (2009), Reinhart and Reinhart (2010) and Drehmann and Juselius (2012).

¹² To fulfil its mandate to preserve financial stability pursuant to article 1 of the Financial Stability Oversight Act (*Gesetz zur Überwachung der Finanzstabilität*) in cooperation with BaFin in accordance with article 5 of this law.

¹³ Article 33 SolvV and article 10d (3) KWG.

¹⁴ Article 5 (1) of Council Regulation (EU) No. 1024/2013 of 15 October 2013.

¹⁵ In simplified terms, relevant credit risk exposure are the institutions' claims against the private non-banking sector subject to credit risk (loans as well as securities). Not included in the calculation of relevant credit exposure are, in particular, exposures to central and regional governments and other public sector entities, central banks and multilateral development banks, international organisations and institutions/banks (for a precise definition, see article 36 (1) SolvV).

¹⁶ Article 10d (3) KWG.

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the weighted average of the domestic and all foreign CCB rates for the countries to which the institution has relevant credit exposure. They are weighted according to the ratio of the own funds requirements for credit risk with regard to the relevant credit exposure in the country in question to the total own funds requirements for credit risk that relates to the institution's entire relevant credit exposure.¹⁷ The resulting CCB rate refers to the institution's total risk-weighted assets (RWAs).¹⁸ It must be satisfied with common equity Tier 1 capital.¹⁹

2.2 Principle of guided discretion

When setting the buffer rate (or making any other economic policy decision), a balance must be struck between formal rules and discretionary actions. The advantages of discretionary decisions lie in their flexibility, which enables the financial supervisory authority to respond promptly to latest developments. However, discretionary decisions make it harder for market participants to form expectations. Moreover, purely discretionary decisions entail certain risks, for example because necessary measures may not be implemented (inaction bias) or measures may be influenced by individual political interests. Focusing on a formal rule that can be clearly communicated and verified reduces such risks. It also enhances the credibility of economic policy decisions and helps to coordinate the expectations of market players.

However, it is very difficult to implement formal rules in the area of financial stability. To date, it lacks a straightforward, quantitative target variable as opposed, for example, to monetary policy. To establish a strict CCB rule, a reliable indicator for buffer activation and adjustment is needed. Currently, there is no such indicator, either in theory or in practice. It is therefore practically impossible to apply a credible rule that will function automatically.

Consequently, the principle of guided discretion combines formal rules and discretionary leeway.²⁰ This gives the supervisory authority the necessary flexibility. At the same time, it mitigates the aforementioned disadvantages associated with purely discretionary decisions (inaction bias, political influence).

Here, the buffer guide represents the rule-based component. The starting point for calculating the buffer guide is the credit-to-GDP gap. Empirical analyses demonstrate that the credit-to-GDP gap is the best indicator for activating the CCB (section 3.1). However, focusing on the buffer guide derived from the credit-to-GDP gap does not mean that the CCB rate is set automatically. There is also a fundamental problem why this is not the case – in addition to the reasons already mentioned above. The signalling properties of an indicator can be negatively affected if it is turned into a target variable for a policy, because market participants with rational expectations will react to the announced change in market conditions.²¹ Accordingly, an indicator rule cannot replace the decision-makers' analysis.

¹⁷ Article 10d (2) KWG.

¹⁸ Article 10d (3), sentence 1 KWG in conjunction with article 92 (3) CRR. CRR denotes Capital Requirements Regulation: Regulation (EU) No. 575/2013 of the European Parliament and of the Council of 26 June 2013.

¹⁹ Pursuant to article 10d (1) KWG, the countercyclical capital buffer must be provided in addition to the common equity Tier 1 capital that is required for compliance with the following own funds requirements: 1) own funds requirements pursuant to article 92 CRR, 2) increased own funds requirements to hedge risks and risk elements not covered by article 1 CRR pursuant to article 10 (3) KWG, 3) increased own funds requirements under article 10 (4) KWG and 4) capital conservation buffers pursuant to article 10 c KWG.

²⁰ Within the meaning of the AFS's macroprudential strategy; see AFS (2014, p. 52).

²¹ This problem is known as the Lucas critique or Goodhart's law; see Lucas (1976) and Goodhart (1975).

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A comprehensive risk assessment should complement the rule-based component (section 4.3).²² Its core element consists in an analysis of supporting indicators that encompass important aspects of financial stability, such as key figures on the real estate market or on the private sector debt burden. However, additional quantitative and qualitative information gained from market intelligence, banking supervision and stress tests may also be considered.

That means that deviations from the buffer guide are possible, but should always be clearly justified and communicated (section 4.4). At the same time, the decision-making process may look different, depending on the CCB phase. In the build-up phase, the buffer guide is always the starting point for calibrating the buffer rate. However, it is possible to deviate from the buffer guide if supporting indicators or the qualitative risk assessment suggest doing so.²³ The more closely the risk assessment corresponds to the indication of the buffer guide, the more likely the latter will play a key role in determining the CCB rate.

In contrast, and by way of exception, during an acute stress phase the buffer guide is not the focal point.²⁴ The underlying credit-to-GDP gap is too sluggish to quickly signal crisis-related developments.²⁵ Moreover, the data for this indicator are available only on a quarterly basis and are subject to a delay. Consequently, a reduction in the buffer rate may be justified even if the buffer guide has not yet given a signal to that effect, but other information (e.g. financial market indicators that are available in a timely manner) points in that direction. A justification is required whenever the announced CCB rate deviates from the buffer guide. The greater the deviation, the more detailed the justification must be. Focusing on the rule-based component and clearly justifying and communicating any deviations help to ensure that the decisions regarding the CCB are transparent and comprehensible. Ultimately, this will also help to ensure that the tool will have the intended effect.

2.3 Transmission channels

The CCB's effects are spread through various channels. The CCB's intended effect on the resilience of the banking system is to be achieved directly through the build-up of the capital buffer.²⁶ In the event of stress, if the common equity Tier 1 capital previously accumulated through the CCB is released, the regulatory capital requirement decreases. Credit institutions can use – without further constraints – the freed-up capital to cushion the impact of losses. This makes it more likely that negative chain reactions and a downward spiral can be avoided or softened. All of this can help to prevent an excessive restriction of the supply of credit and reduce the risk of a credit crunch during times of crisis.

Moreover, increasing the own funds requirement can have a moderating effect on the expansion of lending. Thus, the CCB may help to dampen the build-up of systemic risks, thereby lowering the probability of financial crises. There are two ways this positive effect may materialise. First, the higher own funds requirement may be achieved in part by

²² Section 4, principle 3 BCBS (2010b).

²³ Therefore, article 10d (3), sentence 3 KWG only stipulates that the credit-to-GDP gap must be considered, but is not the sole factor in setting the buffer rate.

²⁴ See recommendation D.3 in ESRB (2014) on the need for greater discretionary leeway in this case.

²⁵ See e.g. Detken et al. (2014, pp. 43 ff.).

²⁶ If the banks already have enough equity capital to meet the higher requirements, the CCB “conserves” resilience. The banks in question are not required to adjust their common equity Tier 1 capital.

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reducing lending. Second, the banks may make loans more expensive, depressing demand for credit and, therefore, aggregate credit growth. The preconditions for such a price effect are that the banks' cost of equity must be higher than their debt costs and an increase in regulatory requirements must lead to higher overall costs of capital.²⁷ Moreover, in such a scenario, the institutions must be able to pass on the higher cost of capital to their borrowers.

The aforementioned mechanisms can enable the CCB to reduce procyclicality in the financial system, i.e. an increase in cyclical fluctuations through excessive or insufficient lending.²⁸ At the same time, the more banks are constrained (in good times) by the equity restriction, the greater the tool's impact will be.

Influencing market participants' expectations can enhance the CCB's effectiveness. When a credible announcement is made that an instrument is to be used, the market players concerned already anticipate future conditions and adjust their behaviour accordingly. It can therefore be assumed that the measure's effectiveness will accelerate. For example, if it is announced that the buffer rate will be raised in the coming quarters, this will have a dampening effect on lending more quickly if the institutions meet the higher capital requirements in full sooner than required. On the other hand, when reducing the buffer, it is important to announce how long the measure will last in order to facilitate the institutions' capital planning and to provide them with incentives to lend. Both the KWG and the SolvV therefore stipulate that a time period should be indicated during which no increase in the buffer rate is planned.²⁹

By contrast, transferring risks to areas not affected by the CCB regulation can weaken the desired transmission of the tool. In particular, this includes the possibility that banks may switch to risk positions that are less affected, or not affected at all, by regulatory requirements³⁰ (e.g. certain government bonds). This could adversely affect banks' resilience. On the other hand, bank loans could be replaced by loans from shadow banks, thereby reducing the impact of the CCB regime. Consequently, the following must always be reviewed: first, whether adverse effects can be reduced by using other instruments; second, whether such effects threaten to cancel out the intended positive effect of using the CCB.

Because only limited experience on use of the CCB is available, even internationally,³¹ it is hard to predict how effective it will ultimately prove to be. However, **the empirical literature** on the impact that capital buffers in general or tools with a similar effect have in this area **provides some initial clues.** Box 1 gives an overview of the relevant studies. On the whole, these show that setting the capital buffer at an adequate level is critical for its successful use. Moreover, they highlight the danger that risks will be transferred to areas not affected by activation of the CCB. In this context, it is important to practise reciprocity, i.e. for governments to recognise each other's buffer rates in order to prevent evasive reactions within the banking sector.

²⁷ This assumption is disputed. For example, Hellwig (2010) argues that by improving their equity base, banks will improve their credit rating, which may lead to lower risk premiums and, thus, to reduced costs of capital.

²⁸ Nevertheless, the purpose of the CCB is not to fine-tune either the business cycle or the credit cycle.

²⁹ Article 10d (5), sentence 1 KWG; article 34 (2), no. 6 SolvV.

³⁰ Ultimately, the institution-specific CCB requirement refers to an institution's total RWAs. Accordingly, it addresses not just those credit segments in which excessive lending is taking place; on the contrary, it has a broad and general impact. This may lead to a shifting of activities among various credit segments.

³¹ For instance, the CCB requirements in Norway and Sweden became binding for the first time in June and September 2015, respectively.

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Box 1: Empirical evidence on transmission channels

The empirical literature shows that a higher equity ratio enhances banks' resilience.³²

Moreover, the literature provides evidence that (in the longer term), there is a positive correlation between equity capital and lending.³³ During times of crisis, in particular, the level of equity becomes more important for lending.³⁴ Thus, during the global financial crisis, better capitalised banks granted more loans than comparable institutions with lower equity ratios (given a fixed demand for credit).³⁵ These results indicate that the CCB could help to prevent banks from excessively restricting the supply of credit during such phases.

Studies on dynamic risk provisioning also indicate that additional equity capital can have a stabilising effect on lending during times of crisis. Dynamic risk provisioning was introduced in Spain in 2000. It stipulates that risk provisions should be set up in a forward-looking way over the entire credit cycle. As with the CCB, a portion of the accumulated risk provisions can be released during bad times, ensuring that banks have a larger buffer to absorb losses. The relevant studies show that dynamic risk provisioning enhanced the institutions' ability to absorb losses whilst stabilising corporate lending during the crisis.³⁶ According to the study by Jiménez et al. (2012), among banks that set up above-average risk provisioning in the run-up to the crisis, a one percentage point increase in the reserve translated into a 10 % increase in loans granted.

However, the evidence as to whether a countercyclical tool can curb excessive credit growth is mixed. For example, a study by Saurina (2009) on dynamic risk provisioning is unable to show that this tool exercised a significant dampening effect on the excessive expansion of credit in Spain. However, the author stresses that overall the tool was able to achieve a countercyclical effect. Nevertheless, this was overshadowed by structural changes (for which the tool was not designed). By contrast, other papers conclude that increased capital requirements can have a moderating impact on credit expansion.³⁷ Moreover, the literature shows that during the build-up phase, the buffer's effectiveness is highly dependent on whether loans from regulated banks can be replaced by financing that is unaffected by this regulation. For example, according to studies for the United Kingdom,³⁸ around one-third of the decrease in lending by domestic banks was offset by an increase in lending by branches of foreign banks not covered by British regulations.

³² See e.g. Berger and Bouwman (2013) and Porath (2006) for Germany.

³³ For Germany, see Buch and Prieto (2014).

³⁴ See e.g. Cornett et al. (2011) as well as Gambacorta and Marqués-Ibáñez (2011).

³⁵ See Carlson et al. (2013).

³⁶ See Saurina (2009) and Jiménez et al. (2012). However, Saurina (2009) also shows that dynamic risk provisioning was ultimately not sufficient to effectively protect the entire banking sector against the financial crisis.

³⁷ For more on this, see the simulation study by Drehmann and Gambacorta (2012) for Spain and Aiyar et al. (2012, 2014) for the United Kingdom.

³⁸ See Aiyar et al. (2012, 2014).

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2.4 Policy evaluation

The use of macroprudential tools should be reviewed to determine whether targets have been met.³⁹ As a result, calibrating the buffer rate for the CCB involves carrying out not only an ex ante analysis but also an ex post evaluation of the tool. During the quarterly evaluation of the buffer rate, ex ante and ex post analyses overlap, because for every decision regarding the buffer rate, the risk situation is re-assessed by comparing it to the previous quarter. However, it is less the short-term analyses than the fundamental analyses of the developments over several years that are at the heart of the evaluation.

The impact of an activated tool should be evaluated over longer time periods. As a rule, the affected institutions are given one year to satisfy the respective new requirements.⁴⁰ Even after the established deadline has expired, the effects in terms of the CCB target may not yet be fully discernible. Therefore, an evaluation should be carried out after several years have passed.

The complex regulatory environment in which banks operate makes it more difficult to evaluate the impact of a specific macroprudential tool. If necessary, several regulatory measures may be adopted simultaneously in order to address various aspects of a risk situation in a targeted manner.⁴¹ In addition, for international active banks, various countries' CCB rates will apply. The effect of the domestic buffer rate is blurred by the fact that each bank defines its own institution-specific CCB rate using the weighted average of domestic and all foreign CCB rates for countries in which it holds relevant credit risk positions. Basically, the overall effect of the CCB on systemic risk can only be assessed if changes in behaviour and the risk-bearing capacity of the financial corporations affected by evasive reactions are also evaluated.

An important precondition for the systematic ex-post evaluation of the effectiveness of the CCB is a clear operationalisation of its objective, i.e. a strengthening of the resilience of the banking sector that should have a stabilising effect on lending during a stress situation. Basically, ex post impact analyses should clarify

- (i) Whether the CCB attains its goal,
- (ii) Whether evasive reactions are seen, and which ones, and
- (iii) Whether effects materialise that could weaken the desired transmission of the CCB.⁴²

Before a measure is adopted, it should already be clear which indicators should be used to measure goal attainment.

³⁹ AFS (2014, p. 53).

⁴⁰ According to article 10d (4) KWG.

⁴¹ For example, a series of measures was introduced in Sweden to address the problem of rising housing prices in conjunction with a high level of indebtedness households. The measures involved an upper limit for the loan-to-value ratio, a lower limit for housing loan risk weightings, as well as higher risk weightings under Pillar 2 and, finally, the CCB. See Capital requirements for Swedish banks. Finansinspektionen, Memorandum of 8 May 2014 and 8 September 2014:

http://www.fi.se/upload/90_English/20_Publications/20_Miscellaneous/2014/kapital_eng.pdf and http://www.fi.se/upload/90_English/20_Publications/20_Miscellaneous/2014/kapitalkrav-svenska-banker-140910enNY.pdf, July 2015.

⁴² See AFS (2015).

The basic rationale behind indicators and indicator selection

3 The basic rationale behind indicators and indicator selection

3.1 Theoretical considerations

The CCB should be built up during phases of excessive credit growth in order to achieve its goal of enhancing the resilience of the banking system to cyclical systemic risks. The first question this raises is: when is credit growth excessive? Credit expansion is appropriate if it is compatible with the fundamental factors that determine the link between credit risk and return. One of the most important factors for the profitability and risks of projects to be financed is economic growth.⁴³ Normally, the credit trend follows typical fluctuations in the business cycle without reinforcing them. However, a distinction can be made between various frequencies in the fluctuations seen in credit aggregates. As a rule, the medium-term component of credit aggregate fluctuations is referred to as the credit cycle. On average, credit cycles last between 8 and 30 years.⁴⁴ Persistent phases of strong credit growth may occur in connection with these fluctuations.

Credit growth may be classified as excessive if it is strong for a long period of time and at the same time is largely disconnected from trends in the real economy (especially growth prospects).

In order to assess whether credit growth is excessive, mainly indicators of credit developments are analysed – especially the credit-to-GDP gap. This indicator shows to what extent the credit-to-GDP ratio deviates from its long-term trend. Because of structural differences in financial systems (bank-based versus market-based), the level of credit-to-GDP ratios differs around the world. As a result, a long-term trend value is calculated at the national level. The credit-to-GDP gap shows to what extent, historically, lending expands faster than economic output in a given country. If the current credit-to-GDP ratio is significantly higher than its long-term trend value, this is an indication of excessive credit growth. Empirical studies show that the credit-to-GDP gap would often have been a good early-warning indicator of banking crises.⁴⁵ It can provide several years' advance notice of a stress period associated with excessive credit growth. Further information on, for example, credit growth rates and prices may help to judge the appropriateness of the credit expansion.

In this respect, it is important to analyse the key drivers of credit growth, especially developments in the real estate market. This is because many banking crises were caused by exaggerations in the real estate market, such as the sub-prime crisis or the difficulties facing Spanish banks in 2012. A sharp rise in real estate prices is often accompanied by strong growth in real estate loans combined with loose credit standards.

Second, indicators that show which risks to the financial system arise from excessive credit growth are needed. The first relevant consideration is whether an abrupt correction of exaggerations triggering a stress period is likely. An important factor in this context is, for example, the type of financing. A financial system that depends on foreign funds is more vulnerable to shocks. Foreign investors often have only a limited capacity to adequately assess domestic risks. As a result, foreign capital inflows will be withdrawn more

⁴³ On the one hand, economic growth influences which projects are profitable. On the other hand, the default risk of the projects is highly dependent on economic development.

⁴⁴ See Aikman et al. (2014).

⁴⁵ See, e.g., Detken et al. (2014) and Drehmann et al. (2010) and the sources they cite.

The basic rationale behind indicators and indicator selection

quickly and are more volatile.⁴⁶ Moreover, market sentiments and valuation levels of financial assets may, in general, render a correction of excessive credit growth more likely.

In addition, the extent of systemic risks depends on how resilient the private sector and the banking system are if and when a correction of the excess credit growth occurs. In turn, the resilience of the private sector and the banking system depend to a large extent on their respective total debt levels. Banks can reduce excessive, inadequately priced lending by not renewing maturing loans and by demanding higher interest. If non-financial corporations and households have high debt levels, they are more vulnerable to increasing loan costs, let alone a reduction in their existing loans. As a result, more loans will default, and banks will record higher losses. This entails the risk that procyclical effects will occur, leading to a credit crunch. The higher the banking sector's equity ratio is, the more it will be protected against shocks. The risk that banks will have to reduce the supply of credit is then lower.

In deciding whether to release the buffer in a stress situation, it is necessary to assess whether lending terms are deteriorating sharply and a credit crunch is looming. The aim should be to release the buffer before restrictions become more widespread. In particular, a reduction in the supply of credit can be expected if banks' refinancing conditions deteriorate sharply or the banks face high losses. It is therefore important to gain knowledge about the banks' refinancing situation and their need to recognise write-downs. In addition, an overall assessment of whether the banking system is in a stress phase is required.

3.2 Selecting the indicators

This section describes the approach for selecting specific variables. The theoretical considerations in the previous section provide a framework of factors that are relevant from a theoretical standpoint. In the next step, these factors are operationalised using specific indicators, the empirical relevance of which must be tested. By and large, this analysis distinguishes between two types of indicators – early-warning indicators that are suitable for the CCB build-up phase, and stress indicators that are suitable for the timely release of the buffer during stress phases. Ideally, early-warning indicators should be capable of signalling the materialisation of systemic risks with sufficient lead time (one to five years). By contrast, stress indicators should signal financial or banking system-wide stress in real time.

Specific variables for Germany were selected in several stages. First, the statutory requirements (supported by empirical evidence) and the ESRB recommendation were taken into account. The statutory requirements are based on empirical studies by the BCBS. Both the BCBS and the ESRB have analysed data covering a large number of countries and a large number of banking crises.⁴⁷ This has the advantage that there is a sufficiently large number of crises to be able to carry out statistically valid studies of the indicators' signalling properties.

Second, the Bundesbank also analysed other empirical studies in order to identify relevant variables. The focus here was on studies of industrialised countries. The risk factors and variables collected from these two steps proved to be of significant relevance for

⁴⁶ See, e.g., Aiyar (2012).

⁴⁷ See BCBS (2010b) and Drehmann et al. (2010) and Detken et al. (2014), respectively.

The basic rationale behind indicators and indicator selection

the average of countries examined. However, these results do not necessarily apply to the same extent to any single country, including Germany.

Third, therefore, the properties of the indicators for Germany were studied. Based on work by the ESRB, the period from the first quarter of 2000 to the fourth quarter of 2003 was identified as the only relevant stress period since 1970.⁴⁸ Reunification triggered growth in aggregate domestic lending that lasted for several years. As a consequence, due to high insolvency rates among borrowers,⁴⁹ banks were forced to report high levels of write-downs. It should be noted that when reviewing CCB indicators, the only relevant stress periods are those that were linked by excessive domestic credit growth in the private non-financial sector.⁵⁰ The global financial crisis and the subsequent European debt crisis do not satisfy this definition, because here the systemic risks originated abroad.⁵¹ In some cases, it was no longer possible to clearly assign the causes of earlier stress periods in the German banking sector, or other drivers were determined to be the critical factors.⁵²

Because only one stress period is available, only a qualitative assessment can be carried out to assess the signalling properties of indicators for Germany. This paper therefore draws heavily on the ESRB recommendation, because it is based on an extensive empirical study carried out for the 28 EU member states.

In addition, there are data restrictions which must be taken into account when selecting specific variables for Germany. For example, important criteria include an adequately long time series and the avoidance of statistical breaks in the data. In addition to statistical breaks, changes in the regulatory environment and structural changes in the economy also complicate the analysis.⁵³ Finally, the quality of the data also plays an important role.⁵⁴

It is also clear, following an intensive analysis, that whilst the best possible indicators were chosen, these may change in future based on new analyses and information. Therefore, the set of indicators and the methodology for determining the buffer rate are to be regularly reviewed and, where necessary, updated. At the same time, future domestic and international experience with the CCB regime as well as developments in procedures agreed in Europe and internationally are to be taken into account.

⁴⁸ See Detken et al. (2014, p. 56).

⁴⁹ See Deutsche Bundesbank (2002).

⁵⁰ Consequently, the definition includes only a portion of the banking/financial crises referred to in the literature. Therefore, it is not possible to use the dating for stress periods from crisis databases such as, for example, in Laeven and Valencia (2013).

⁵¹ If the buffers in the respective countries had been activated at that time, German banks with international credit exposure would, of course, have built up a buffer for their foreign positions in the run-up to the crisis (in accordance with the provisions on international reciprocity).

⁵² The problems in 1974, the key event of which was the insolvency of Herstatt Bank, are an example of another stress phase in the German banking system. The cause of the strain on the banking sector was the high level of commitments in the foreign exchange business and the associated settlement risks. They led to a wave of contagion among medium-sized private banks and regional banks. Risks also materialised from the strong expansion in lending to the construction industry. These risks could have been addressed in a more targeted fashion with sector-specific tools than with the broad-based CCB.

⁵³ For example, most relevant long time series in Germany include a statistical break in the data following reunification, as the data for West Germany were combined with the data for re-united Germany. One example of structural changes is the declining role of banks as lenders in the external financing of German non-financial corporations; see Deutsche Bundesbank (2012, pp. 13 ff.). Changes in the regulatory environment occur due to the introduction of Basel I, II and III, which affect reporting.

⁵⁴ See annex A.

Indicators for assessing the CCB rate in Germany

4 Indicators for assessing the CCB rate in Germany

4.1 Overview

Statutory provisions refer to the credit-to-GDP gap as an important variable for determining the appropriate CCB rate. The credit-to-GDP gap serves as an indicator of excess domestic credit growth. A gap exists if the ratio of aggregate credit amount to gross domestic product deviates from its long-term trend. The buffer guide is a mapping of the credit-to-GDP gap onto the interval between 0 % and 2.5 %. The CCB rate typically lies within this range.

Additionally, this methodological framework suggests a basic structure of supporting indicators. These can help shape more robust decisions regarding the activation, adjustment and release of the CCB. Selection of the indicators summarised in table 1 is based both on the theoretical considerations presented in section 3.1 and on their empirical relevance. Use of the variables is in line with the ESRB recommendation.⁵⁵ Sections 4.2 and 4.3 below introduce the credit-to-GDP gap and the buffer guide and the supporting indicators in detail. These indicators are evaluated by default. Moreover, if necessary, additional data can be analysed in order to clarify specific issues or to better understand the reasons behind certain developments. Finally, section 4.4 describes which variables are particularly informative for decisions on release of the buffer.

⁵⁵ Recommendations C and D in ESRB (2014).

Indicators for assessing the CCB rate in Germany

Table 1: Overview of the indicators

Categories	Indicators
Rule-based component	<ul style="list-style-type: none"> • Standardised credit-to-GDP gap and buffer guide (i.e. based on total debt) • National credit-to-GDP gap and buffer guide (i.e. based on bank credit*)
Bank credit and total debt	<ul style="list-style-type: none"> • Credit-to-GDP ratio (total debt) • Credit-to-GDP ratio (bank credit) • Real growth in total debt • Real growth in bank credit* • Real growth in bank credit* (HHs) • Real growth in bank credit* (NFCs) • Net interest spread
Real estate market	<ul style="list-style-type: none"> • Growth in residential real estate prices • Real growth in housing loans • Lending standards for housing loans
External imbalances	<ul style="list-style-type: none"> • Current account balance as a percentage of GDP
Mispricing of risks	<ul style="list-style-type: none"> • Real long-term interest rate • DAX 30 price index • VDAX volatility index • Spread on corporate bond yields (spread based on iBoxx indices)
Private sector debt burden	<ul style="list-style-type: none"> • Debt service ratio (HHs) • Debt service ratio (NFCs)
Soundness of banks	<ul style="list-style-type: none"> • Tier 1 capital ratio • Unweighted capital ratio • Non-performing loans • Loans with increased default risk
Stress in the financial system	<ul style="list-style-type: none"> • Stress indicator for the German financial system • EURIBOR-OIS spread • Average CDS spread for German banks

* Based on the cumulative sum of changes in the outstanding amount of loans adjusted for statistical changes. Note: HHs denotes households; NFCs denotes non-financial corporations.

Indicators for assessing the CCB rate in Germany

4.2 The credit-to-GDP gap and the buffer guide

There are various options for determining the credit-to-GDP gap and the buffer guide. In addition to the standardised calculation following the Basel proposal, a national method may also be adopted.⁵⁶ In fact, a thorough data analysis for Germany shows that a national method should be used. Both calculation methods are described in detail below.

Standardised method

The credit-to-GDP gap calculated according to the standardised method is based on the total debt of the private non-financial sector (chart 1). Box 2 describes the calculation procedure, including determination of the buffer guide. The following components of the national financial accounts are used to measure the total debt of the private non-financial sector:⁵⁷

- Loans and other liabilities of domestic households and non-profit institutions serving households;
- Loans and other liabilities (excluding insurance technical reserves) and debt securities of domestic non-financial corporations.⁵⁸

Corporate debt is considered on a consolidated basis, i.e. only the corporate sector's liabilities to other sectors are considered.⁵⁹ The literature is divided over whether it is preferable to use consolidated or unconsolidated debt for the credit-to-GDP gap. On the one hand, trade credit extended between companies of the same sector can to some extent replace bank loans, as a result of which the amount of total debt is more likely to be underestimated on a consolidated basis. On an unconsolidated basis, on the other hand, there would be substantial double-counting, for example through financial relationships within a group, which might lead to an overestimation of the total debt amount.⁶⁰ In Germany, the advantage of the consolidated approach is that a long time series of historical data is available.⁶¹

⁵⁶ See Recommendations B.1 and B.3 a), Recommendations B.2 and B.3 b) and c) and Recommendations B.5 a) and c) in ESRB (2014).

⁵⁷ See annex B.1 and annex B.3. See also Dembiermont et al. (2013).

⁵⁸ Genuine stock corporations (joint stock corporations (*Aktiengesellschaften*), limited liability companies (*Gesellschaften mit beschränkter Haftung*), etc.) and quasi stock corporations (primarily partnerships (*Personengesellschaften*), i.e. general partnerships and limited partnerships (*offene Handelsgesellschaften: OHGs and Kommanditgesellschaften: KGs*)); see Deutsche Bundesbank (2015).

⁵⁹ See Deutsche Bundesbank (2015).

⁶⁰ For example, Blomberg et al. (2012) demonstrate that a significant portion of the total debt of non-financial corporations in Sweden can be explained by internal group liabilities, which in some cases results in double-counting of loans (in the case of parent companies and subsidiaries).

⁶¹ In contrast to unconsolidated debt, the pre-1991 consolidated figures are available on at least an annual basis. Long time series are important for a reliable calculation of the HP trend; see annex A.

Indicators for assessing the CCB rate in Germany

Box 2: Credit-to-GDP gap and buffer guide: standardised method

The Basel III proposal (BCBS, 2010a and 2010b) consists of three steps.

Step 1: Measuring aggregate domestic credit volume and GDP. To accomplish this, the BCBS recommends using a broad credit aggregate. This includes loans to the domestic private non-financial sector from domestic and foreign sources as well as debt securities of domestic private non-financial corporations. For a period t , existing total debt volume D_t and GDP_t are measured at current (nominal) prices at the end of the quarter; a four-quarter moving sum of GDP is calculated: $GDP_{t-3} + GDP_{t-2} + GDP_{t-1} + GDP_t$.

Step 2: Calculating the credit-to-GDP gap, G_t . To do this, the difference between the credit-to-GDP ratio, R_t , and its long-term trend T_t is calculated:

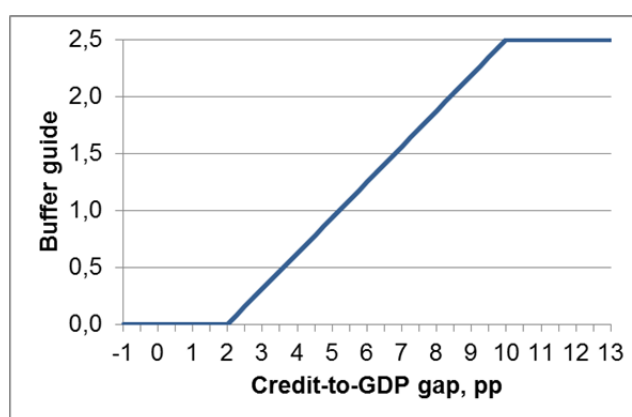
$$G_t = R_t - T_t, \quad \text{where} \quad R_t = D_t / (GDP_{t-3} + GDP_{t-2} + GDP_{t-1} + GDP_t) \times 100 \%$$

At the end point of a time series, t denotes the period with the most recently available figure. The HP filter breaks down the time series for the credit-to-GDP ratio into a cyclical component and a trend component.⁶² Following an initialisation period at the beginning of the time series, the trend is successively calculated for a part of the time series, which is extended by one quarter at a time, until it reaches the most recent observation (recursive filtering; see Borio and Lowe, 2002). The cyclical component – credit-to-GDP gap – is the difference between the credit-to-GDP ratio and its trend and is measured in percentage points (pp).

Step 3: Calculating the buffer guide, BG_t . To do this, the following formula is applied:⁶³

- for $G_t \leq 2$ pp: $BG_t = 0$;
- for $2 \text{ pp} < G_t \leq 10$ pp:
 $BG_t = 0.3125 \times G_t - 0.625$;
- for $G_t > 10$ pp: $BG_t = 2.5$.

Accordingly, the buffer guide (as a % of RWA) is only greater than zero if the credit-to-GDP gap is greater than 2 pp. The maximum buffer guide of 2.5 is reached where the credit-to-GDP gap is 10 pp or greater.

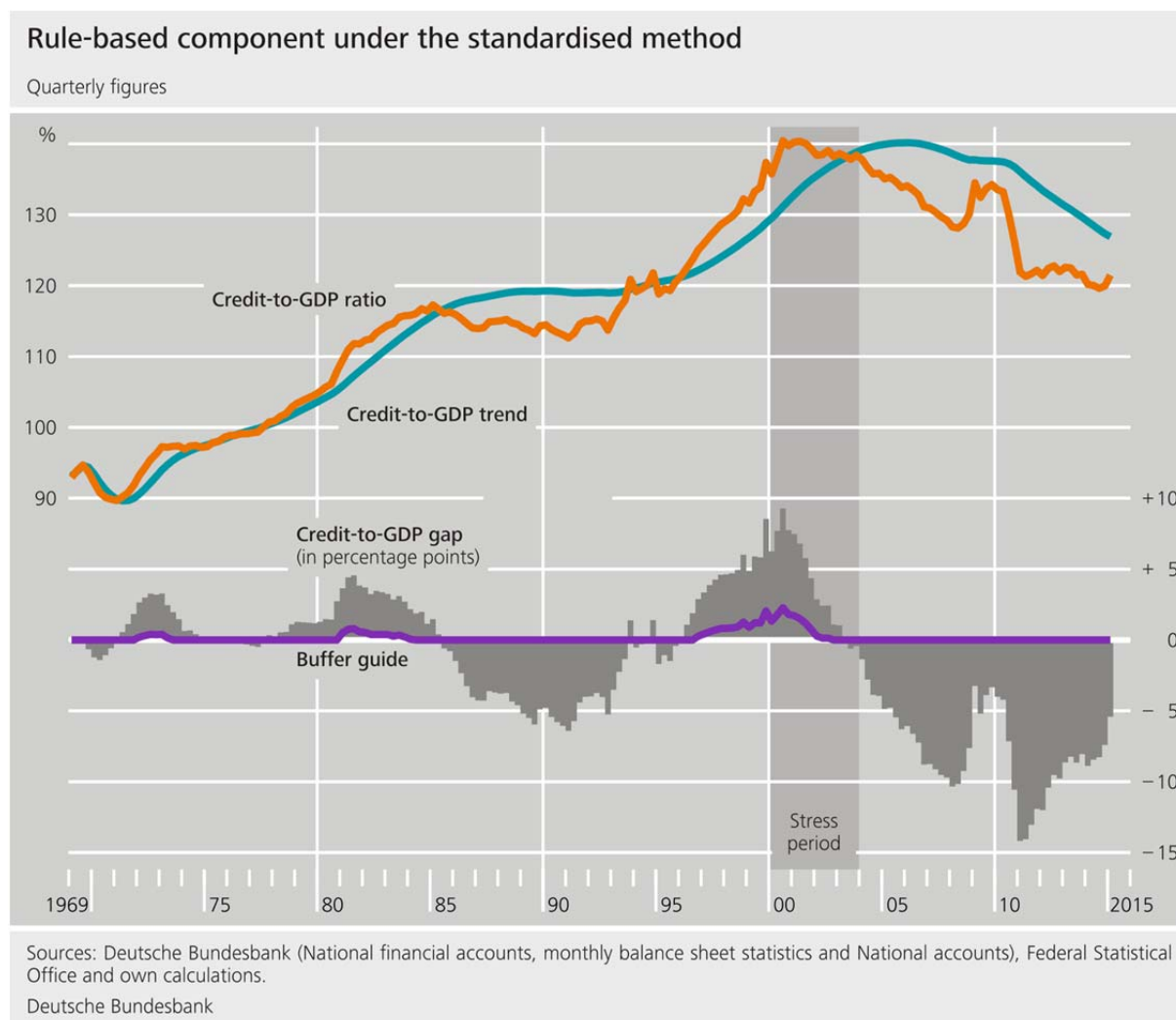


⁶² The Hodrick-Prescott filter (HP Filter; Hodrick and Prescott, 1981) with a smoothing parameter of 400,000 is used; see annex A.

⁶³ See ESRB (2014, annex, part II).

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Chart 1



National method

The standardised calculation is modified for the national method (chart 2): The first modification concerns the definition of the aggregate credit amount. The second modification concerns the formula used to calculate the buffer guide. By contrast, the calculation of the long-term trend remains unchanged, because none of the alternatives analysed is clearly superior to the Basel III proposal (see annex A).

The aggregate credit amount is measured as bank loans and debt securities of the private non-financial sector held by domestic banks and money market funds (bank credit). The data come from the monthly balance sheet statistics of domestic monetary financial institutions, supplemented by statistics from money market funds. Unlike the total debt time series, no additional – in particular, foreign – financing sources are included here. Specifically, the aggregate credit amount consists of the following components:⁶⁴

- Loans from domestic banks to domestic households and non-profit institutions serving households;

⁶⁴ See annex B.2 and annex B.4.

Indicators for assessing the CCB rate in Germany

- Loans from domestic banks to domestic non-financial corporations;
- Debt securities of domestic non-financial corporations held by domestic banks and money market funds.

Bank loans are of outstanding importance for the German economy. On the one hand, they are the main source of external financing for domestic non-financial corporations, although their importance has declined since the turn of the millennium.⁶⁵ On the other hand, households almost exclusively obtain loans from domestic banks.⁶⁶ The bank credit examined here, which also includes debt securities in addition to bank loans, accounted for between 64 % and 78 % of the total debt time series in the period from 1968 to 2014. At the end of 2014 this figure stood at 65.3 %.

It is particularly beneficial that there is a long, consistent time series for bank credit (beginning in the fourth quarter of 1968). This time series is used to calculate the buffer guide under the national method. It is based on the cumulative sum of changes in the outstanding amount of loans in which statistical changes have been eliminated.⁶⁷ The indicator based on this credit aggregate shows better early-warning properties (see the evaluation further below).

The second modification concerns the calculation of the buffer guide. A (positive) credit-to-GDP gap may expand merely as a result of a decreasing GDP.⁶⁸ To prevent an inappropriate increase in the CCB in such a situation, which would have a pro-cyclical effect, the formula is adjusted accordingly. In all other respects, the formula defined by Basel III remains unchanged (box 3).

Box 3: Credit-to-GDP gap and buffer guide: national method⁶⁹

Steps 1 and 3 of the national method differ from those in the standardised method (box 2).

Step 1 modification: The aggregate domestic credit amount is measured using the loans and debt securities to the private non-financial sector held by domestic banks and money market funds.

Step 3 modification: The formula for calculating the buffer guide BG_t is adjusted such that a decrease in GDP will not cause the buffer guide to increase:

- If at the end of a given quarter t the year-on-year change in real GDP is negative, and if the buffer guide calculated exceeds the figure in the prior quarter $t-1$, the figure for the prior quarter, BG_{t-1} , shall continue to apply;
- Otherwise, the value calculated for quarter t , BG_t , shall apply.

⁶⁵ See Deutsche Bundesbank (2011) and Deutsche Bundesbank (2012).

⁶⁶ See Deutsche Bundesbank (2011).

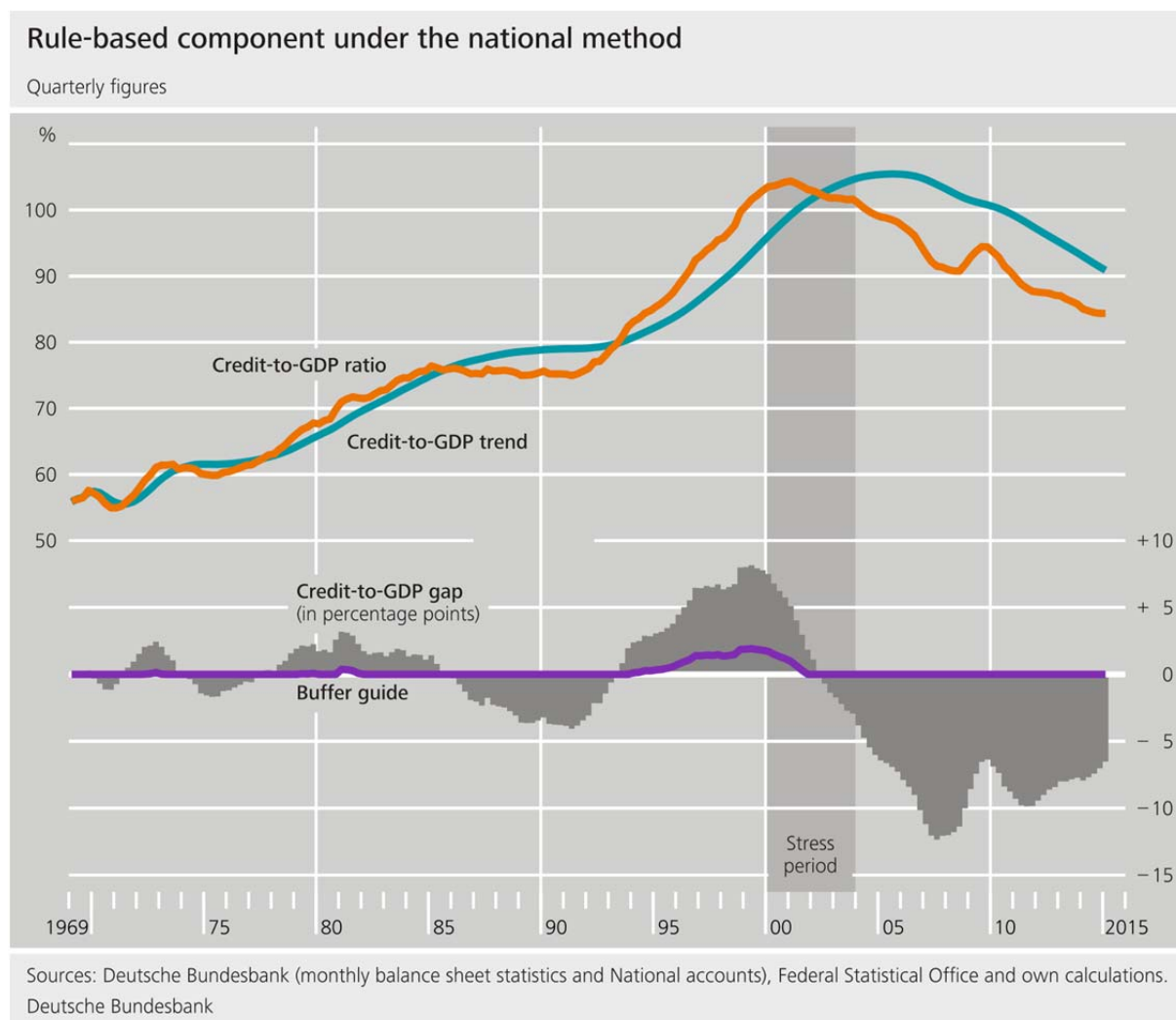
⁶⁷ Because the definition of the data changes from time to time, the Bundesbank provides time series on the changes in the outstanding amount of loans that have been adjusted for statistical changes.

⁶⁸ See annex A.

⁶⁹ In accordance with Recommendations B.2, B.3 c) and B.4 in ESRB (2014).

Indicators for assessing the CCB rate in Germany

Chart 2



Evaluation

A number of studies of different groups of countries show that in the past, the credit-to-GDP gap could have served as an adequate early warning indicator of periods of stress in the financial system.⁷⁰ Corresponding studies also largely support the usefulness of the indicator for the individual western European countries.⁷¹ For Germany, a relevant analysis is possible only to a limited extent, because only one relevant stress period was identified (see section 3.2).

The national method shows the best results for Germany. Chart 3 compares the buffer guides calculated ex-post based on three different credit time series: (i) total debt (standardised method), (ii) outstanding amount of bank loans and (iii) bank credit, measured as the sum of changes in the outstanding amount of bank loans adjusted for statistical

⁷⁰ See Detken et al. (2014), Behn et al. (2013), Drehmann (2013), Alessi and Detken (2011), Drehmann et al. (2010, 2011), Borio and Drehmann (2009) and Borio and Lowe (2002), amongst others.

⁷¹ See Giese et al. (2014), Gerdrup et al. (2013), Bonfim and Monteiro (2013), Valtiovarainministeriö (2012), Juks and Melander (2012), DNB (2010) and Harmsen (2010). By contrast, using the credit-to-GDP gap presents a challenge to most of the economies-in-transition in Central and Eastern Europe, whose credit markets expanded quickly and steadily following the transition from a planned economy to a market economy; see Geršl and Seidler (2011).

Indicators for assessing the CCB rate in Germany

changes (national method). The buffer guide that has been calculated under the national method exhibits fewer misleading signals than that calculated under the standardised method.⁷² Moreover, in the run-up to the identified stress period, it signals the activation of the CCB considerably earlier. This is beneficial for three reasons. First, sufficient lead time is required because statistical data are only available after a period of time has elapsed. In addition, a certain minimum response time is required. This is because the buffer rate set generally only becomes binding after a 12-month period. Finally, when taking decisions in the face of uncertainty, it may be important to have enough time to gradually raise the buffer rate in order, if need be, to avoid an overreaction when the measure is announced.

The indicator determined using the national method would have indicated a build-up phase for the CCB for the years 1993 to 2000. By contrast, neither method would have shown a positive buffer guide in the run-up to the global financial crisis that erupted in 2007. At that time, the risks to the German financial system originated abroad. Therefore, the signal for the buffer build-up would have had to come from the competent authorities in those countries where the risks originated.⁷³ In this situation, German banks would have had to build up a capital buffer vis-à-vis their relevant foreign credit exposure in accordance with the international reciprocity agreements for the CCB regime.

If there are only a few stress periods, it is very difficult to reliably assess the signalling properties of the credit-to-GDP gap. Consequently, the buffer guide serves as guidance for decisions on setting the appropriate level of the CCB rate. However, the signal it sends should be verified using additional variables that are also capable of giving a (prompt) indication of the build-up of cyclical systemic risks.

4.3 Supporting indicators

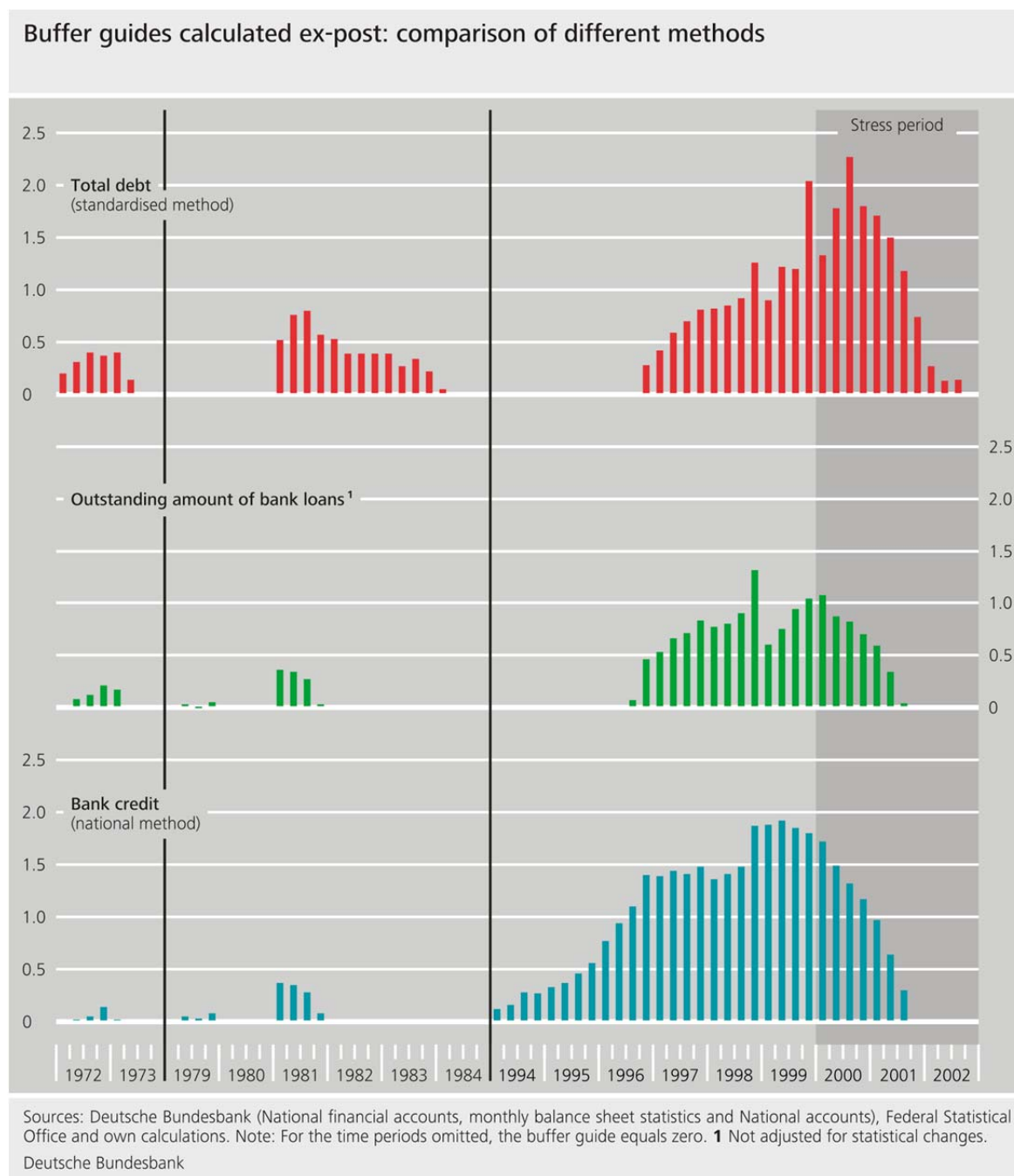
In addition to the credit-to-GDP gap, a number of supporting indicators are evaluated. These include, first, variables that indicate whether the credit growth is excessive. Then follow variables that indicate the likelihood of a correction of the abnormal development. Additionally, indicators are considered that show how heavy the debt burden is for the private non-financial sector and banks, and how resilient the sectors are. Finally, indicators of the level of financial system stress are discussed. These should help assess the risk of a credit crunch and identify the right time for releasing the buffer.

⁷² In general, the indicator is prone to misleading signals in the “initial phase”, because the “long-term” trend is based on only a few observations; see annex A. Results at the beginning of a time series must therefore be interpreted with caution. A calculation based on time series calculated approximately back to 1950 (using temporary disaggregation) has demonstrated that the swings in the credit-to-GDP ratio at the beginning of the 1970s and 1980s disappear when the data extend further back into the past.

⁷³ Assuming that these risks were linked to the excessive growth of credit to the private sector in their jurisdiction.

Indicators for assessing the CCB rate in Germany

Chart 3



4.3.1 Bank credit and total debt in the private non-financial sector

Credit-to-GDP ratio

In addition to its deviation from the long-term trend, the credit-to-GDP ratio itself provides important information. For example, an economy with a high private debt ratio is more vulnerable to shocks, although there are no generally recognised thresholds for the unsustainable level of debt.⁷⁴ Empirical analyses indicate that the expansion of total private

⁷⁴ See Reinhart and Rogoff (2009) and Juselius and Drehmann (2015), for example.

Indicators for assessing the CCB rate in Germany

debt (measured as a percentage of GDP) may be related to declining productivity from a certain point onwards.⁷⁵ As part of its Macroeconomic Imbalance Procedure Scoreboard, the European Commission uses a (consolidated) total debt threshold of 133 % of GDP. Due to structural differences between countries and not always consistent definitions of data, there is considerable uncertainty with regard to determining specific, uniform thresholds. In Germany, the credit-to-GDP ratios reached their historic high point in 2000 and 2001 (chart 1 and chart 2). In particular, the credit-to-GDP ratio calculated under the standardised method had already exceeded the indicative threshold of 133 % of GDP before the identified stress period.

Credit growth

In addition to the level of private debt, the speed with which it is increasing provides indications as to whether the expansion of credit is excessive.⁷⁶ Therefore, annual growth rates of total debt and bank credit serve as important indicators in the CCB analytical framework. In addition, to better understand the causes, bank credit is examined separately in the form of loans to non-financial corporations and loans to households, and in each case the real annual growth rates are analysed.⁷⁷

Comparing real bank credit and total debt growth rates with real GDP growth helps to better assess the driving factors behind an expanding positive credit-to-GDP gap. The important issue here is whether the gap is expanding because the aggregate credit volume is growing faster than GDP, as in the 1990s, or because GDP is declining, as it did at the beginning of the 1980s (chart 4).

Loans to non-financial corporations and loans to households may contribute to aggregate credit growth to varying degrees (chart 5). Moreover, loans to corporations and households tend to be subject to different cycles;⁷⁸ empirical studies indicate that rapid household credit growth is more often accompanied by a subsequent banking crisis.⁷⁹ A separate analysis of both sub-aggregates is therefore advisable.

⁷⁵ According to some estimates, for advanced economies, this threshold is approximately 100 % of GDP for the aggregate liabilities (i.e. total debt) of the private non-financial sector and around 90 % of GDP for bank loans; see Cecchetti and Kharroubi (2012) and Arcand et al. (2012). Alessi and Detken (2014) and Detken et al. (2014, pp. 41-42) arrive at similar thresholds in their analyses of the indicators for activation of the CCB.

⁷⁶ See Schularick and Taylor (2012) and Repullo and Saurina (2011) on the role of credit growth.

⁷⁷ In order to facilitate the comparability of growth rates over time, loans are deflated using the GDP deflator. This avoids a bias caused by different inflation rates (see Deutsche Bundesbank, 2011). See also annex B.5 and annex B.6.

⁷⁸ See Busch (2012) and Deutsche Bundesbank (2011) for Germany and ECB (2009) for the eurozone.

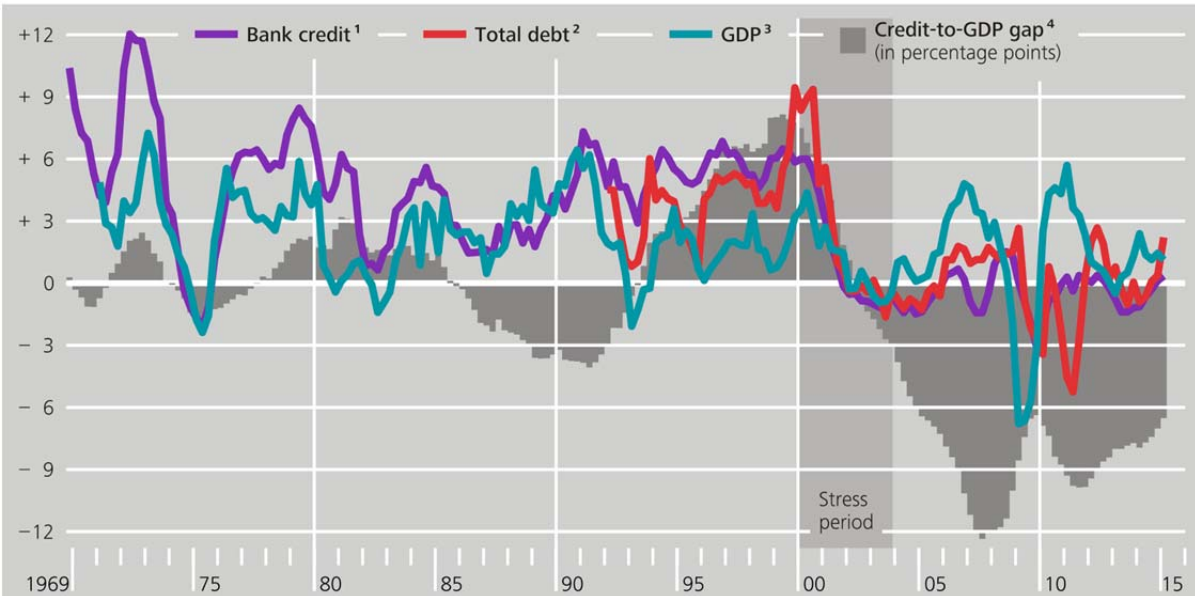
⁷⁹ See Anundsen et al. (2014), Büyükkarabacak and Valev (2010) and Deutsche Bundesbank (2011).

Indicators for assessing the CCB rate in Germany

Chart 4

Real credit and GDP growth *

Changes to the previous year in %, quarterly figures



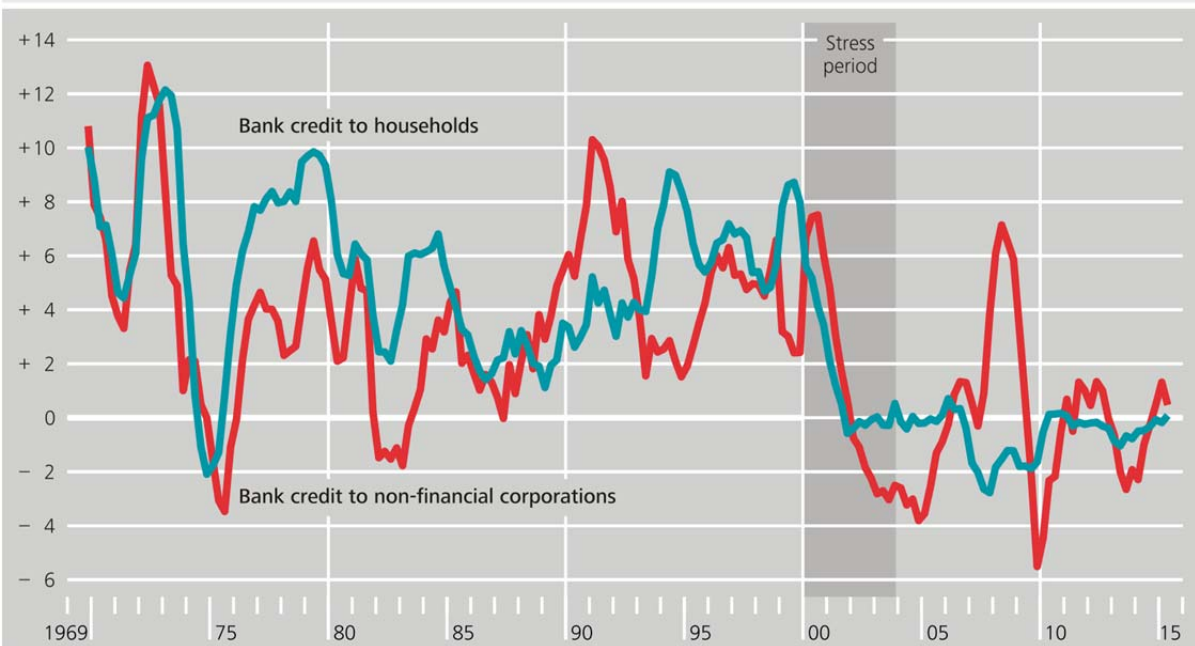
Sources: Deutsche Bundesbank (monthly balance sheet statistics, National financial accounts and National accounts), Federal Statistical Office and own calculations. * Deflated using the GDP deflator. **1** Seasonally adjusted; based on cumulated changes in the stock of loans in which statistical changes have been eliminated. **2** Seasonally adjusted. **3** Calendar-adjusted. **4** Calculated under the national method.

Deutsche Bundesbank

Chart 5

Real credit growth by sector *

Changes to the previous year in %, quarterly figures, seasonally adjusted



Sources: Deutsche Bundesbank (monthly balance sheet statistics and National accounts), Federal Statistical Office and own calculations. * Deflated using the GDP deflator and adjusted for statistical changes.

Deutsche Bundesbank

Indicators for assessing the CCB rate in Germany

Net interest spread

In addition to volume-based indicators, price-based indicators such as the net interest spread provide complementary information about the credit development. The net interest spread is equal to the difference between the lending rate and the banks' refinancing rate. The lending rate is measured as the average interest rate on loans to corporations and households (for the calculation, see annex B.7). To determine the refinancing costs, a synthetic liabilities side is constructed with a maturity structure that matches the maturity classes of the loans extended. The goal is to filter out that portion of interest income that represents the reward for maturity transformation and the associated interest rate risk. The resulting indicator is a simple measure of banks' gross margin (per monetary unit granted). This includes, among other things, compensation for the default risk of the borrowers (credit risk premium). Any assessment of the indicator must take into consideration the fact that it depends on many other factors, such as competition in the banking sector. The net interest spread should always be analysed in conjunction with volume-based indicators.

Based on the net interest spread development, it is possible to draw tentative conclusions as to how to assess strong credit growth. If the credit growth rate or the credit-to-GDP gap is large and the net interest spread is also high and increasing, this could suggest that credit risks are being factored in appropriately. Of course, it is impossible to deduce from this whether the margin received will be used appropriately for risk provisioning. If the net interest spread is already low or is steadily decreasing, this could point to increased risk taking. Because the indicator can only be calculated from 2003 onwards (see chart 6), it is not possible to assess its early-earning quality in the run-up to the identified stress period.

4.3.2 Real estate market

The literature indicates that abnormal developments in the residential real estate market (especially in terms of prices) are a good predictor of banking crises in industrialised countries.⁸⁰ However, sharp price increases in the real estate market do not necessarily pose a risk to financial stability. Combined with the prices, it is important to monitor indicators of real estate loans and corresponding lending standards. When price increases coincide with excessive lending and loose lending standards, the combination may contribute to the build-up of systemic risks.

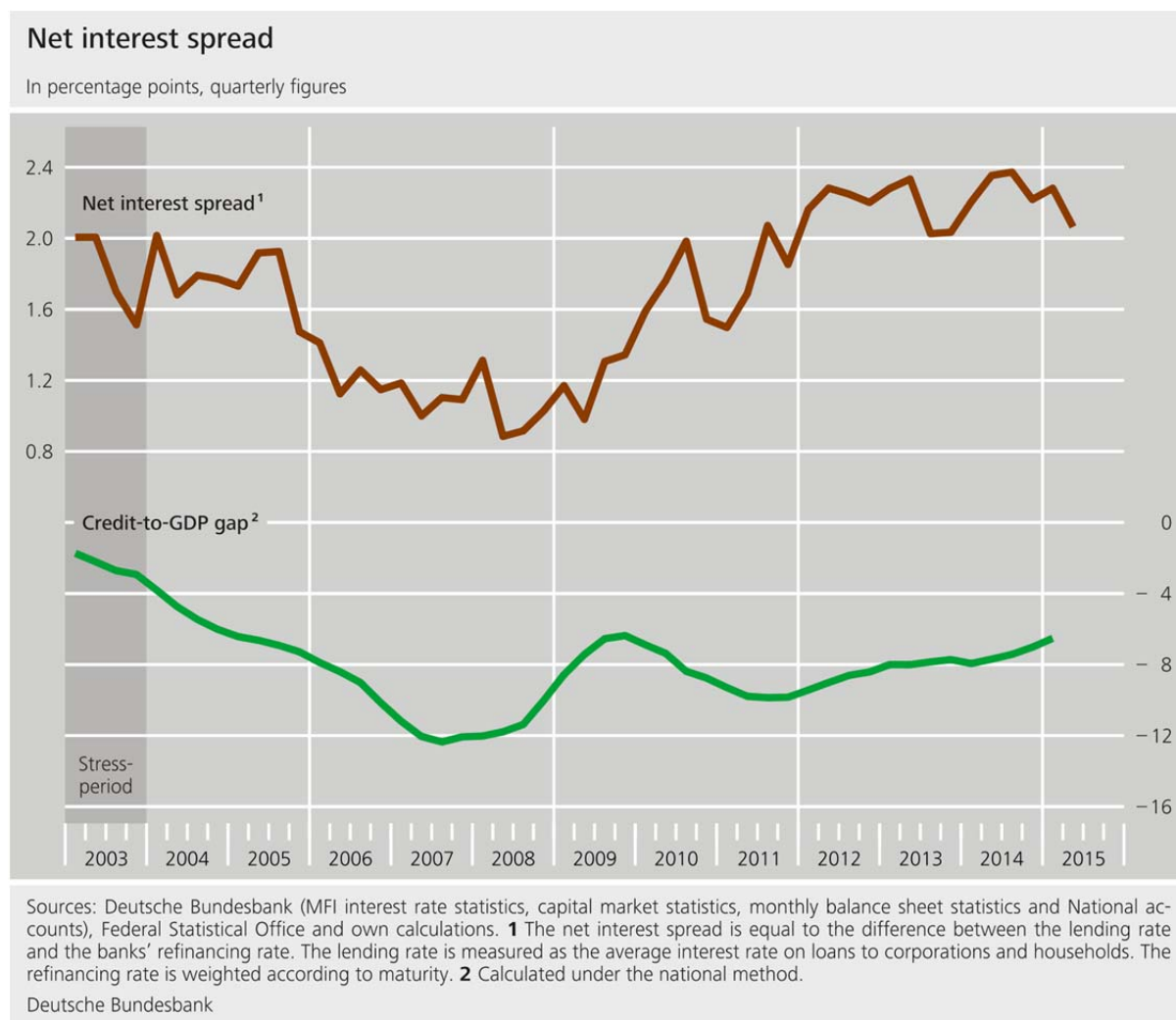
Residential real estate prices are monitored using chain-linked indexes. From 1976 to 2005, residential property prices relate to owner-occupied apartments and terraced houses (data from bulwiengesa AG); from 2006 onwards, they relate to owner-occupied housing (data from vdpResearch GmbH; see annex B.8).⁸¹ Additional indicators include the annual growth in real housing loans to households and non-financial corporations (deflated using the consumer price index, see annex B.9) and lending standards for loans for house purchase obtained from the Bank Lending Survey (see annex B.10).

⁸⁰ For example, see Mian and Sufi (2014), Detken et al. (2014), Roy and Kemme (2011) and Barrell et al. (2010).

⁸¹ For reasons relating to data availability, the indicators used refer only to the residential real estate market. Following the planned improvements in the commercial real estate database (see Recommendation B, item 2 in AFS, 2015), the set of indicators will be expanded to include this segment.

Indicators for assessing the CCB rate in Germany

Chart 6



Lending standards are available only from 2003 onwards. Data on residential real estate loans and prices are available from the end of the 1960s and mid-1970s onwards, respectively. Particularly striking are the high annual growth rates for housing loans during the period from 1993 to 1999, directly before the identified stress period. However, prices had already increased sharply between 1989 and 1994, while afterwards growth slowed down or prices even fell (chart 7). Both housing loan growth rates and those of real estate prices have increased recently. However, both growth rates are substantially below their historical peaks. Lending standards have become tighter since 2009 (chart 8). If risks are identified in the German residential mortgage market, it will also be necessary to check whether it is more appropriate to use tools that focus more narrowly on the residential real estate market than to use the broadly based countercyclical capital buffer.

Indicators for assessing the CCB rate in Germany

Chart 7

Growth in residential real estate loans and prices

In %, yearly and quarterly figures



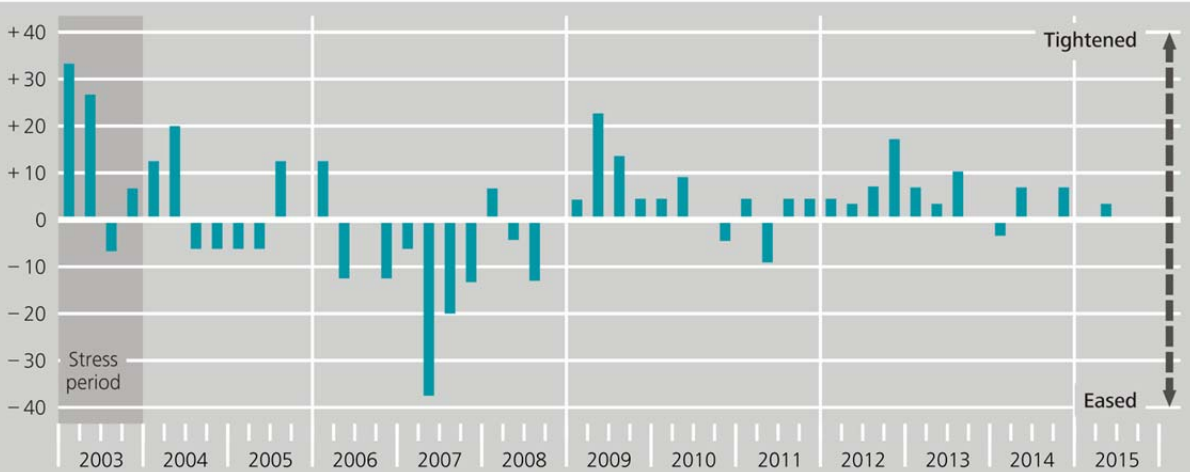
Sources: Deutsche Bundesbank (monthly balance sheet statistics), Federal Statistical Office, bulwiengesa AG, vdp Research GmbH and own calculations. **1** Housing loans to households and corporations. Adjusted for statistical changes. Growth rates are deflated using the consumer price index. Quarterly figures. **2** Based on chain-linked indices. From 1976 to 2005, the data refer to owner-occupied apartments and terraced houses (bulwiengesa AG). From 2006 onwards, residential real estate prices refer to owner-occupied housing (vdpResearch GmbH). 1976 to 2006: yearly figures; from 2007 onwards: quarterly figures.

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Chart 8

Lending standards for housing loans over the past three months

In %, quarterly figures



Source: Deutsche Bundesbank (Bank Lending Survey). Note: Values are unweighted changes, i.e. they show the percentage of banks that have tightened lending standards, minus the percentage of banks that have eased standards.

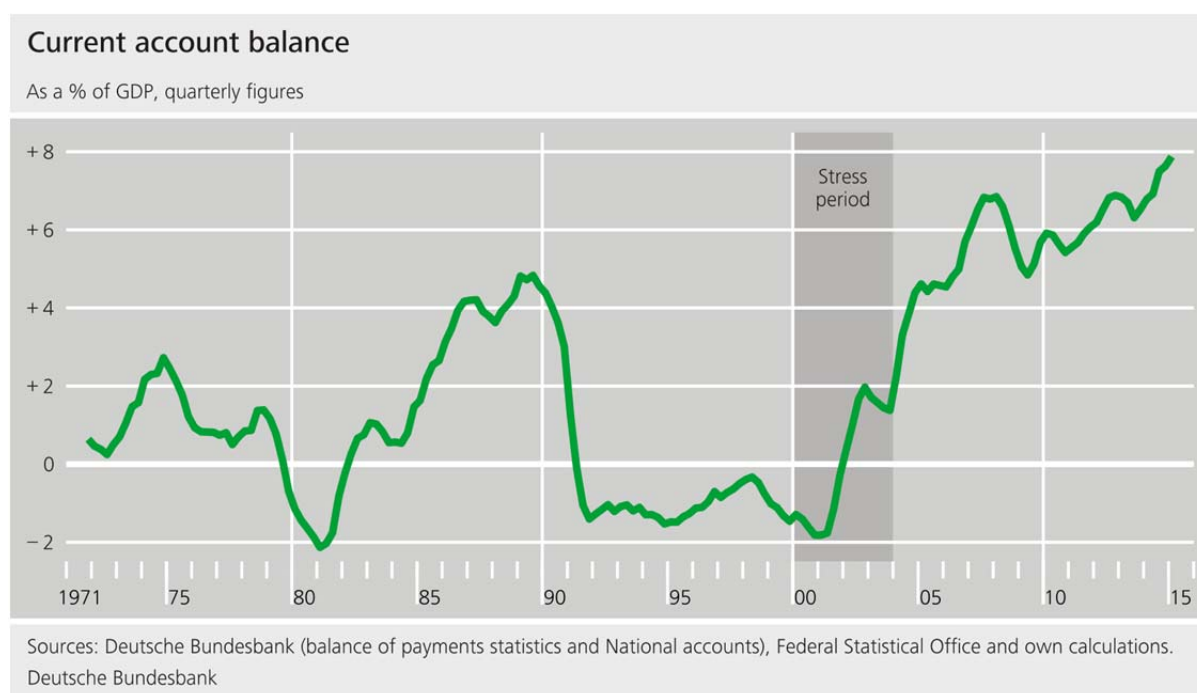
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Indicators for assessing the CCB rate in Germany

4.3.3 External imbalance indicator

Persistent external imbalances indicate additional risks of a high debt level, which is why the current account (as a percentage of GDP) is a good early-warning indicator of financial crises (see annex B.11).⁸² In very general terms, a current account deficit indicates that an economy's net assets are decreasing. The problems associated with persistent current account deficits result primarily from the volatile nature of foreign capital inflows, which tend to be withdrawn again more quickly than domestic funds (see section 3.1). From the 1990s until the beginning of the 2000s, Germany experienced a phase of current account deficits that corresponds to the hypothetical build-up phase of the CCB (chart 9) if the buffer guide based on the national credit-to-GDP gap is used.

Chart 9



4.3.4 Mispricing of risks

Equity market valuation

Equity market valuation is captured by two indicators: first, the annual increase in the DAX price index and second, the VDAX-NEW index, which measures the implicit volatility of the DAX.⁸³ Sharp price increases in the equity market are a tentative sign that risks are being mispriced. The second indicator, the implicit volatility⁸⁴ of the DAX, reflects the uncertainty in the equity market. Here, a relatively low volatility may signal that the share

⁸² See, for example, Detken et al. (2014), Giese et al. (2014), Kauko (2012) and Jordà et al. (2011). According to Laeven und Valencia (2008), most systemic banking crises occurred in countries with a substantial current account deficit. Reinhart and Rogoff (2008) point to the above-average current account deficit in the USA prior to the onset of the sub-prime crisis. On the Macroeconomic Imbalance Procedure Scoreboard, the indicative threshold for the moving 3-year average of the current account balance to GDP ratio is -4 %.

⁸³ See annexes B.12 and B.13.

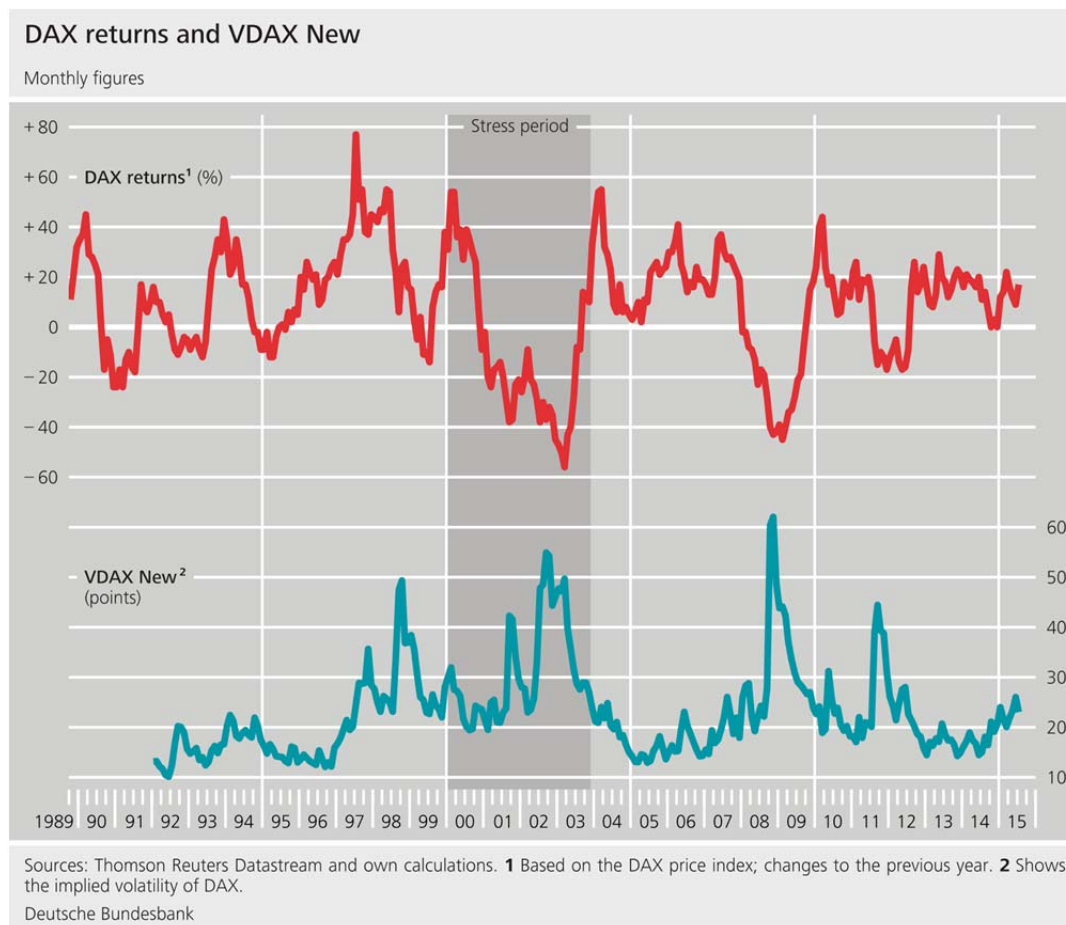
⁸⁴ Implicit volatility refers to a volatility figure that is derived from an option-pricing model.

Indicators for assessing the CCB rate in Germany

price risk is estimated too low. In that case, equity investments tend to be regarded as less risky than they actually are.

Results of empirical studies largely indicate that a sharp increase in share prices may herald future financial crises.⁸⁵ Valuation levels were also very high in Germany prior to the stress period at the beginning of the 2000s (see chart 10). However, it is important to bear in mind that during the period in question, in addition to the credit-related crisis, there was also an equity market bubble (the “dot-com” bubble). Therefore, it is difficult to judge to what extent the increase in equity prices contributed to stress in the lending market. To date, only a few studies have focused on **volatility** as an early-warning indicator. According to one study, for EU countries, lower volatility in the equity market is a significant indicator of a crisis at a later date.⁸⁶ To a certain degree, the trend in the VDAX in Germany bears out these results. At least for the period from 1995 to 1997, volatility levels were very low; however, volatility then increases substantially (see also chart 10).

Chart 10



⁸⁵ For example, Detken et al. (2014), Lo Duca and Peltonen (2013) and Reinhart and Rogoff (2008) find a positive correlation between increases in share prices and the emergence of crises. By contrast, share price increases are not significant according to Behn et al. (2013).

⁸⁶ See Kalatie et al. (2015).

Indicators for assessing the CCB rate in Germany

Bond market valuation

On the one hand, bond market valuation is reflected in the real long-term interest rate. It is measured as the yield on 10-year German government bonds minus the inflation estimate for the same period (see annex B.14 and chart 11).⁸⁷ If the real interest rate is low, this may trigger a search for yield by investors, causing risks to be underestimated and no longer priced appropriately. There is tentative evidence in the literature suggesting that low long-term interest rates make share price booms more likely and may also herald crises.⁸⁸ Admittedly, the sequence of events in Germany prior to the identified stress period matches this scenario. At the same time, though, it is important to remember that the long-term interest rate is affected by a series of factors, meaning that even long periods of low interest rates may occur without a crisis emerging.⁸⁹

On the other hand, the spread on corporate bond yields is taken into account. Here, the iBoxx Euro Non-Financials Bond Index for BBB-rated bonds with a remaining time to maturity of 7 to 10 years is used and the spread over German government bonds with the same time to maturity (iBoxx Euro Sovereign Germany) is calculated (see annex B.15 and chart 11). Bond yields for non-financial corporations with a BBB rating are particularly sensitive to changes in the risk situation. Relatively low indicator values that persist for a long period of time may reflect a possible mispricing or underpricing of risks. Because the relevant indices are often not available at the national level or for a long period of time, they have so far not been studied as early-warning indicators. The iBoxx Corporate Bond Index cannot be analysed before and during the identified stress period, as it has been available only for a relatively short period of time.

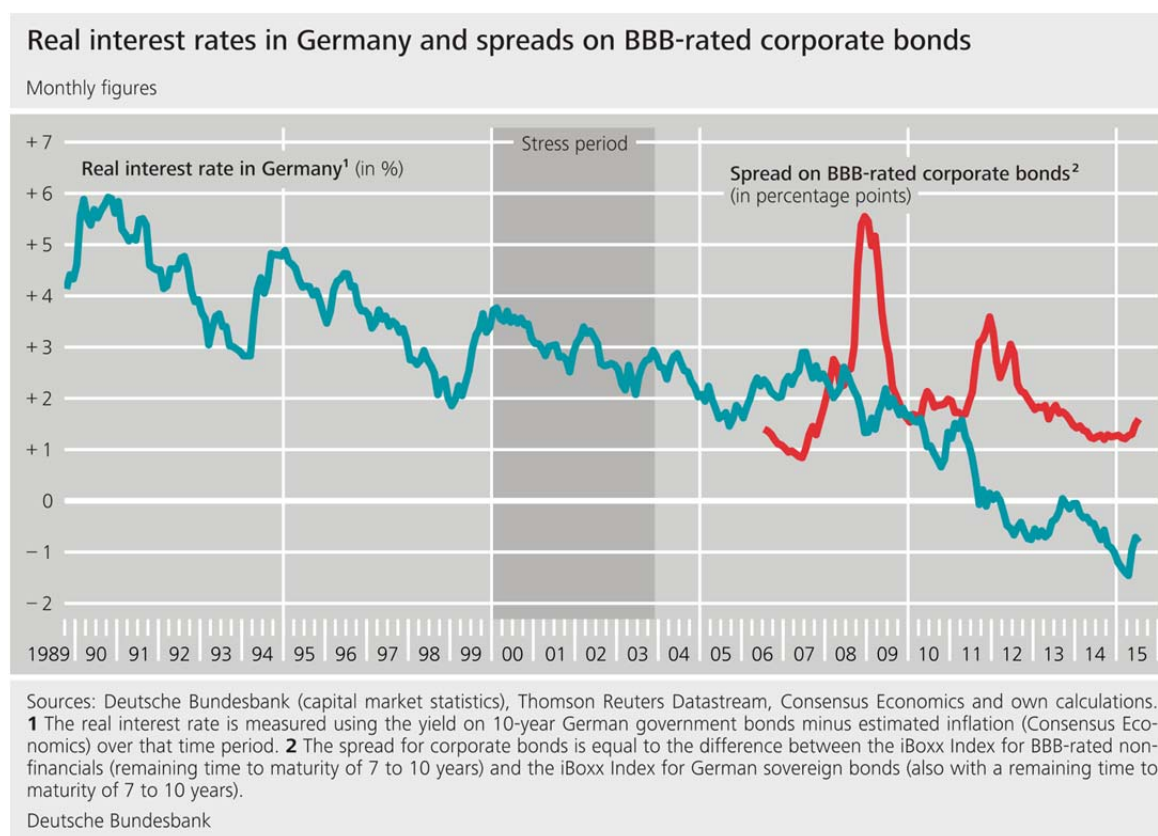
⁸⁷ Inflation rate estimate is derived from forecasts provided by Consensus Economics. For the calculation of the real interest rate, see Deutsche Bundesbank (2001).

⁸⁸ See Borgy et al. (2009) and Detken et al. (2014).

⁸⁹ In the literature on early-warning indicators, the short-term real interest rate is often used. The reason for this is that it is an indicator both of banks' interest rate risk and of financial deregulation. The short-term real interest rate generally has a positive impact on the probability of a crisis. For example, see Demirgüç-Kunt and Detragiache (1998) and Barrell et al. (2010).

Indicators for assessing the CCB rate in Germany

Chart 11



4.3.5 Private non-financial sector debt burden

A high debt burden significantly lowers non-financial corporations' and households' resilience to shocks. The private non-financial sector's current debt burden is captured by the debt service ratio (DSR). The debt service ratio is the ratio of the interest and principal repayments, non-financial corporations and households⁹⁰ must make during a given period to current income (see box 4 and annex B.16).⁹¹ The higher the debt service ratio, the lower the percentage of the respective sector's income that can be used for investment, consumption or savings purposes, and to absorb shocks. Consequently, the DSR allows a better assessment of how resilient the respective sector will be in stress situations and whether the current credit trend involves increased risk (see section 3.1). Empirical studies show that the debt service ratio is a good early-warning indicator for banking crises.⁹² Moreover, there is a positive correlation between the level of the debt service ratio prior to banking crises and the severity of subsequent recessions.⁹³

⁹⁰ Statistically, sole proprietorships and unincorporated partnerships under civil law (*GbR/BGB-Gesellschaften*) are included under households.

⁹¹ Compared to other common indebtedness indicators (e.g. the credit-to-GDP ratio), the DSR has the advantage of explicitly including factors such as changes in the average interest payable.

⁹² See Drehmann and Juselius (2012), Detken et al. (2014) and Kalatie et al. (2015).

⁹³ For international evidence, see Drehmann and Juselius (2012); for the USA, see Mian and Sufi (2009, 2011).

Indicators for assessing the CCB rate in Germany

Evaluating the DSR as an early-warning indicator for Germany runs into the problem that no consistent time series is available covering the period prior to the identified stress period (see box 4). The DSR for the period before 2003 is not directly comparable to that for the period thereafter. Nevertheless, chart 12 shows that from 1999, i.e. around one year before the identified stress period, there is an increase in the debt service ratio, reaching a peak of just over 16 % in the fourth quarter of 2000.

In Germany, the DSR for non-financial corporations⁹⁴ is significantly more volatile than the DSR for households (chart 13).⁹⁵ This appears to be a general empirical regularity; DSRs for non-financial corporations are more closely associated with the business cycle than with the credit cycle.⁹⁶ Both DSRs reach their historic peaks at the beginning of the identified stress period. Currently, both are at a historic low point. Because each DSR is an aggregate figure, DSRs cannot provide any information about the distribution of the debt burden within the respective sectors.⁹⁷ This would require a micro-data-based metric for the distribution of the debt burden which, for reasons relating to data availability, currently cannot be calculated.

Box 4: Calculating the debt service ratio

The debt service ratio is calculated using the following formula (Drehmann and Juselius, 2012):

$$DSR_t = \frac{i_t D_t}{(1 - (1 + i_t)^{-s_t}) Y_t}$$

where D_t denotes current debt, i_t the average lending rate, s_t the average remaining time to maturity and Y_t income for period t . The starting point for the analysis is an instalment loan with an average remaining maturity s_t , because in most countries (including Germany), this is the main form of lending.⁹⁸ For reasons relating to data availability, the average remaining time to maturity is approximated by the average term of the loans.⁹⁹ The average interest rate is calculated as the volume-weighted average of interest rates for loans to households and non-financial corporations.¹⁰⁰

⁹⁴ For data reasons, corporate/entrepreneurial income can only be approximated (see annex B.16).

⁹⁵ Because disposable income data for both sectors are available only from 1991, the sector-specific DSRs prior to 1991 cannot be calculated. At the same time, the two DSR levels are not directly comparable, because different variables are used to calculate the respective disposable income; see annex B.16.

⁹⁶ See Drehmann and Juselius (2012).

⁹⁷ For example, Mian and Sufi (2009) show that in the USA, households with slowly rising incomes before the sub-prime crisis became indebted more frequently and to a greater extent than households with incomes that increased more. At the same time, in the aggregate, the relationship between income and total debt remained unremarkable.

⁹⁸ In addition, differences in repayment structures tend to cancel each other out in the aggregate.

⁹⁹ The average loan term is calculated from the data on outstanding amount loans extended in the past. New business loans are not taken into account. The share of outstanding amount loans in the credit exposure is large, whereas the share of new business loans (originated in that quarter) is very small.

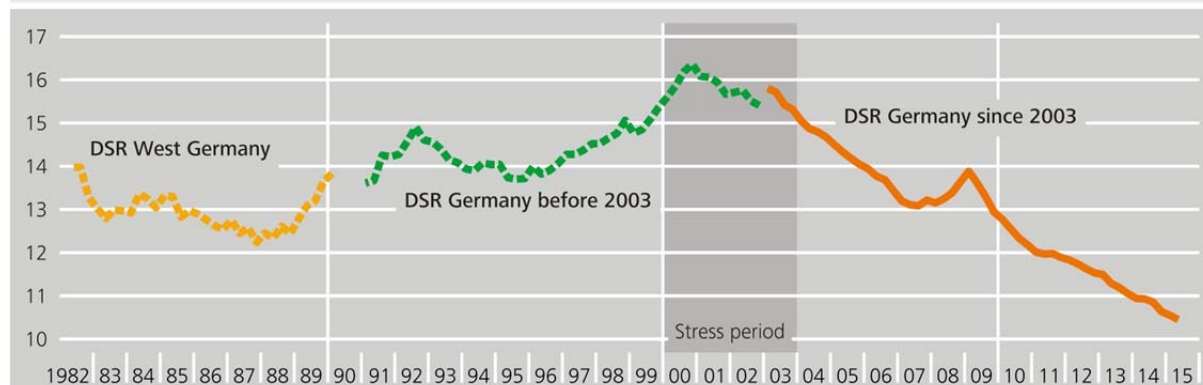
¹⁰⁰ For reasons relating to data availability, until 2003, not all relevant interest rates can be included. The reason for this is the introduction of the EMU interest rate statistics, which replaced the previous national survey in 2003 and provided for another system. Interest rate data from previous national statistics are only comparable to MFI statistics to a limited extent; see the special essay entitled "The new MFI interest rate statistics – methodology for collecting the German data" in Deutsche Bundesbank (2004). For the precise design of these measurements, see the dataset description in annex B.16.

Indicators for assessing the CCB rate in Germany

Chart 12

Debt service ratio: long time series*

In %, quarterly figures



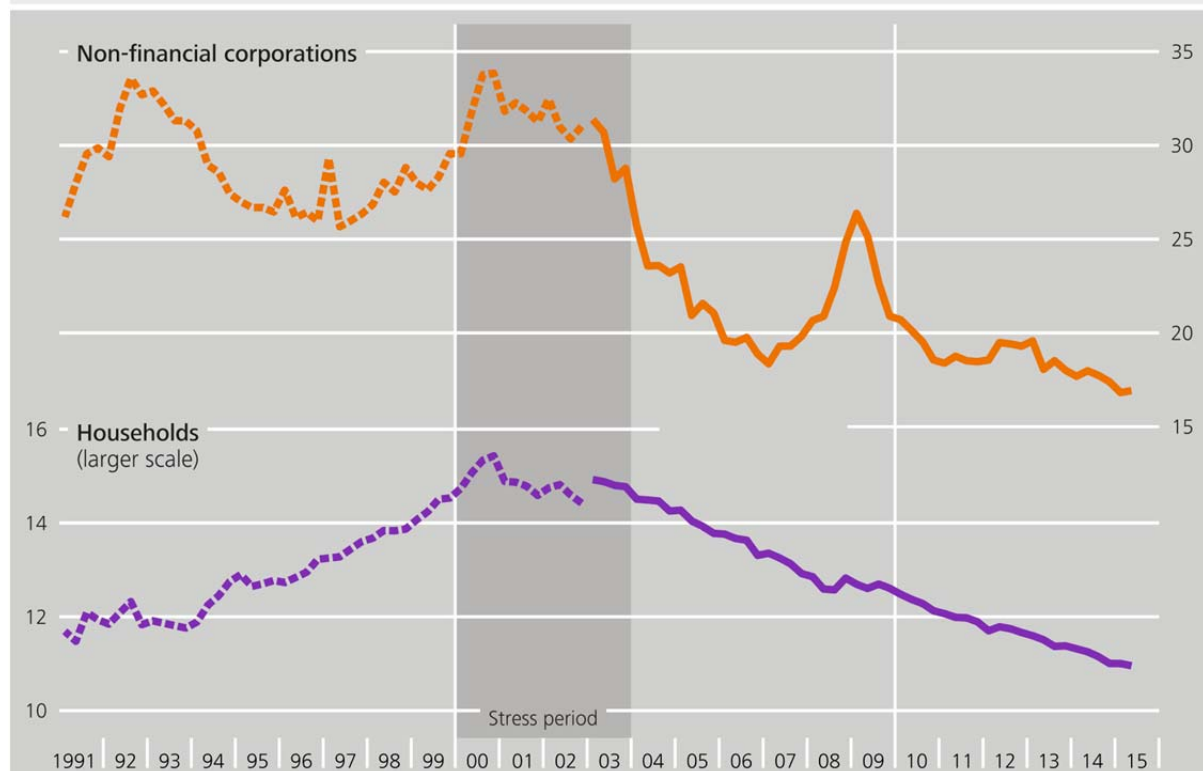
Sources: Deutsche Bundesbank (monthly balance sheet statistics, Bundesbank's interest rate statistics, MFI interest rate statistics and National accounts), Federal Statistical Office and own calculations. * For the period before 2003 the debt service ratio figures are depicted as dashed lines as they are calculated using qualitatively inferior data and are not directly comparable to those for the period thereafter. Note: Missing data for the time period from 1990 Q2 to 1990 Q4 are due to the fact that the GDP data for Germany are available from 1991 onwards and the transition in the bank credit data from West Germany to Germany took place in the second quarter of 1990.

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Chart 13

Debt service ratio by sector*

In %, quarterly figures



Sources: Deutsche Bundesbank (monthly balance sheet statistics, Bundesbank's interest rate statistics, MFI interest rate statistics and National accounts), Federal Statistical Office and own calculations. * For the period before 2003, the debt service ratio figures are depicted as dashed lines as they are calculated using qualitatively inferior data and are not directly comparable to those for the period thereafter.

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Indicators for assessing the CCB rate in Germany

4.3.6 Soundness of the banks¹⁰¹

Capital base

Two indicators are considered here – the Tier 1 capital ratio and the banks' unweighted capital ratio. The Tier 1 capital ratio is the percentage share of Tier 1 capital¹⁰² in a bank's risk-weighted assets (RWA) (see annex B.17). In calculating RWA, riskier assets are assigned a higher weight than less risky assets. By contrast, the unweighted capital ratio does not differentiate on the basis of the degree of risk associated with the positions. It is the ratio of an institution's Tier 1 capital to its total assets (see annex B.18).¹⁰³ Because the unweighted capital ratio treats all assets as equally risky, it is robust in the face of possible calibration errors when determining risk weights.

These ratios show how adequate the banking sector's capital is from two different perspectives. Therefore, they reflect the amount of losses banks can absorb, how resilient banks are, and hence how well they are protected against shocks. In the literature on industrialised countries, the capital base is an important early-warning indicator.¹⁰⁴ For major international banks, there is evidence that the unweighted capital ratio is a better indicator of subsequent financial problems than the risk-weighted capital ratio.¹⁰⁵ Although for Germany, at the aggregate level, the two indicators have no early-warning properties for the identified stress period (see chart 14 and chart 15),¹⁰⁶ at the micro level, the capital ratio is nevertheless an important determinant of critical events in the German banking sector.¹⁰⁷

Credit quality

Credit quality is approximated using two indicators: non-performing loans and loans with increased default risk (see annex B.19 and annex B.20). Above all, both indicators reflect the quality of loans extended in the past. Because they are lagging indicators, they provide information about imminent write-offs and primarily help in the decision as to whether the CCB should be released. The first indicator is only available on an annual basis from 1999 onwards. It is measured prior to deduction of risk provisions and is calculated as a ratio of non-performing loans to total gross loans to non-banks. During the identified stress period, the median and aggregate percentage of non-performing loans increased; the quality of the loan portfolio decreased over time (chart 16). The CCB could have been released. The second indicator (chart 17) comprises (i) loans with an increased probability of default of 4 % or more that are not assigned to a default category, (ii) past due loans and (iii) loans for which individual value adjustments have been made, prior to deduction of individual value

¹⁰¹ There are currently no suitable figures available on the banks' liquidity situation. It is planned that they will be included in the set of indicators at a later date.

¹⁰² The CCB must be held in the form of Common Equity Tier 1 capital. For reasons relating to data availability, Common Equity Tier 1 capital is approximated by Tier 1 capital.

¹⁰³ By contrast, the Basel III leverage ratio also includes off-balance sheet items.

¹⁰⁴ See Barrell et al. (2010) and Karim et al. (2013).

¹⁰⁵ See Bank of England (2014). However, whether the capital ratio or the unweighted capital ratio (or both) is/are required by regulations may play a role.

¹⁰⁶ The charts depict the trend over time of the median values of the relevant indicator, as well as the aggregate values. For example, in the case of the aggregate Tier 1 capital ratio, the entire Tier 1 capital of all banks examined is divided by their total risk-weighted assets. Whilst the aggregate figures may be influenced largely by the big banks, the median should show the indicator's trend among the smaller banks.

¹⁰⁷ For the German savings banks (*Sparkassen*) and credit cooperatives (*Genossenschaften*), see Porath (2006) and Schupp and Silbermann (2015).

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adjustments. In contrast to the non-performing loans, loans with increased default risk are calculated as a percentage of gross volume of loans to banks and non-banks. Although loans with increased default risk can only be obtained from 2014 onwards, they have the advantage that they are available on a quarterly basis, and therefore in a more timely manner.

Chart 14

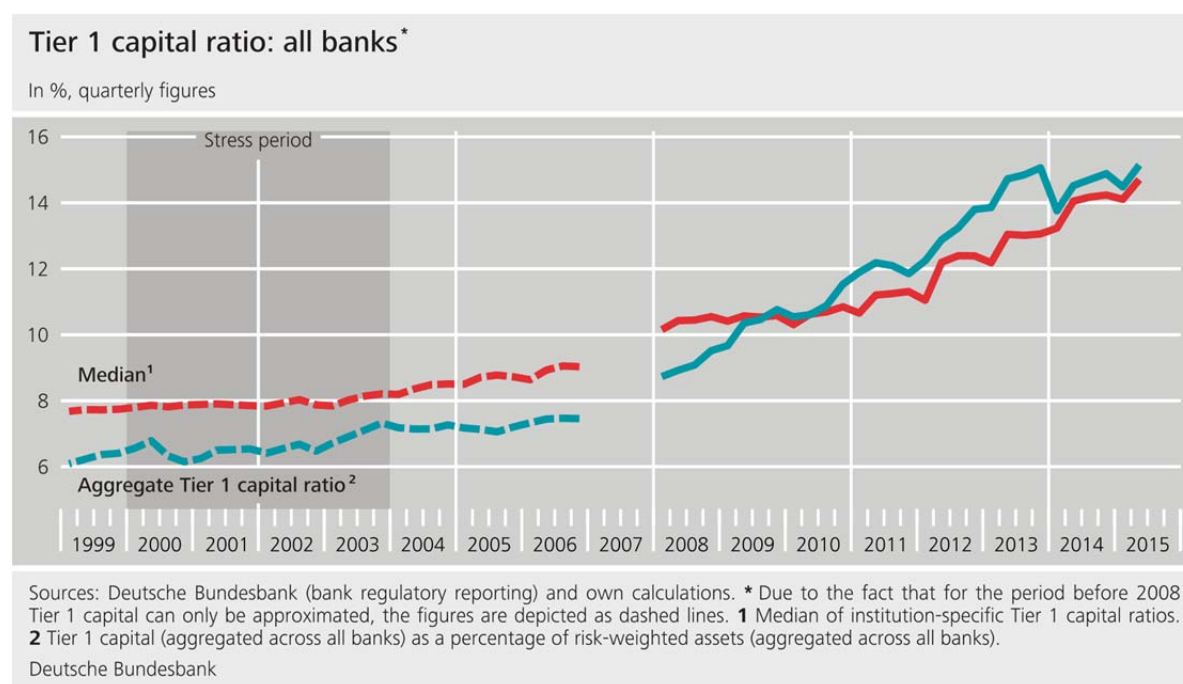
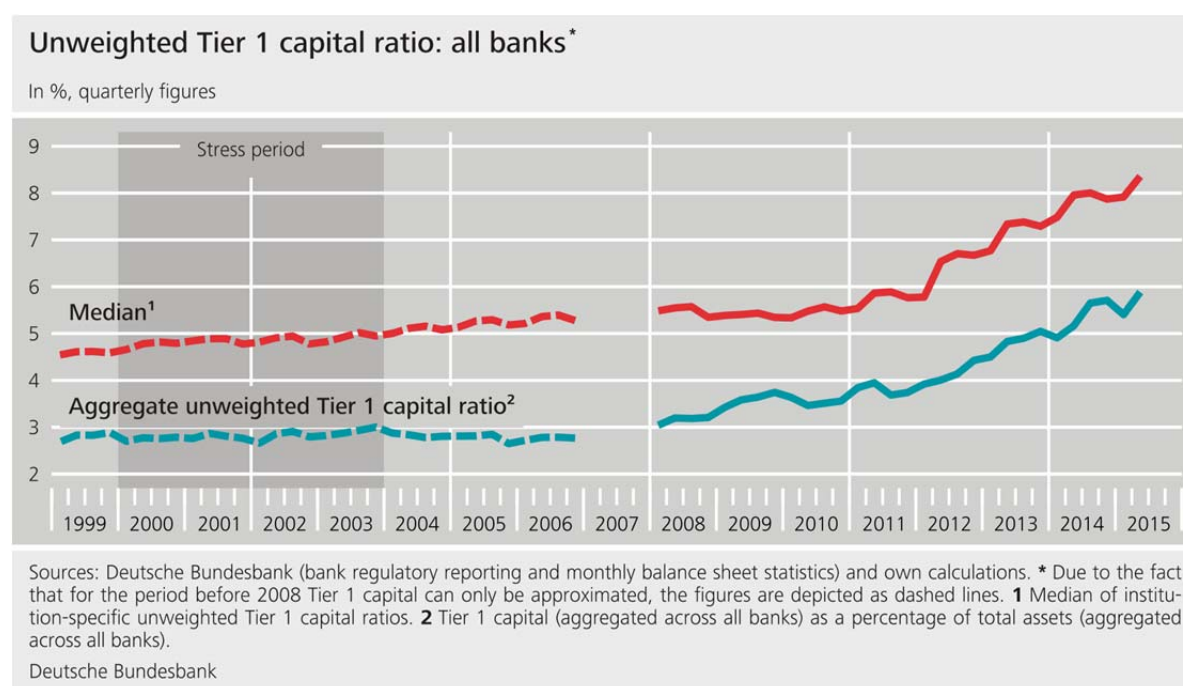


Chart 15

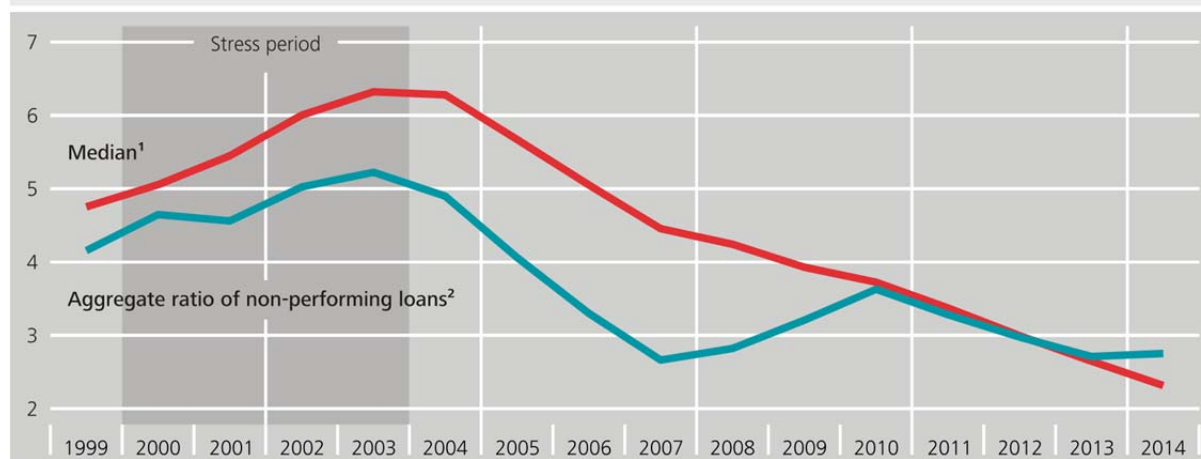


Indicators for assessing the CCB rate in Germany

Chart 16

Non-performing loans as a percentage of total gross loans to non-banks: all banks

In %, annual figures



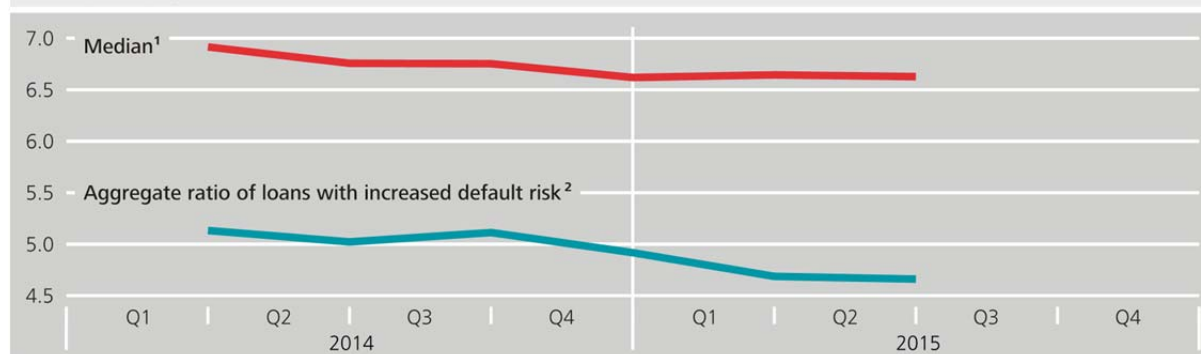
Sources: Deutsche Bundesbank (Special data pursuant to the Audit Report Regulation (PrüfbV)) and own calculations. **1** Median of institution-specific ratios of non-performing loans. **2** Non-performing loans (aggregated across all banks) as a percentage of total gross loans to non-banks prior to deduction of risk provisions (aggregated across all banks).

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Chart 17

Loans with increased default risk as a percentage of gross volume of loans to banks and non-banks: all banks*

In %, quarterly figures



Sources: Deutsche Bundesbank (Special data pursuant to the Former Financial Information now also containing information on risk-bearing capacity (FinaRisikoV)) and own calculations. * Loans with increased default risk consist of loans with increased probability of default of 4% or more that are not assigned to a default category, past due loans and loans for which individual value adjustments have been made, prior to deduction of individual value adjustments. **1** Median of institution-specific ratios of loans with increased default risk. **2** Loans with increased default risk (aggregated across all banks) as a percentage of gross volume of loans to banks and non-banks (aggregated across all banks).

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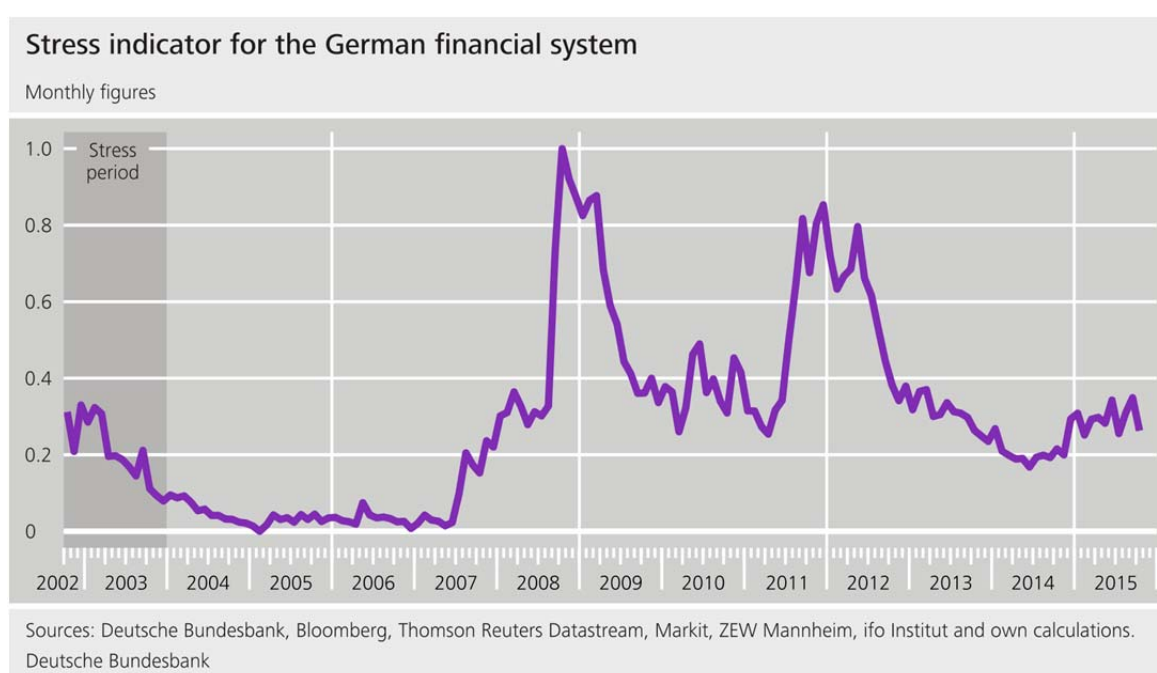
Indicators for assessing the CCB rate in Germany

4.3.7 Indicators of stress in the financial system or banking sector

Stress indicator for the German financial system

The stress indicator for the German financial system calculated by the Bundesbank is used to assess the current risk situation (see annex B.21). It combines a series of financial market indicators on market, credit, contagion and sovereign risks, market and refinancing liquidity and macroeconomic environment indicators.¹⁰⁸ The overall stress indicator is used in accordance with the ESRB recommendation.¹⁰⁹ The indicator showed elevated values in 2002 and 2003, the identified stress period (chart 18).¹¹⁰ The stress indicator reached record highs during the autumn of 2008 after the collapse of the investment bank Lehman Brothers, and during the course of the European sovereign debt crisis.

Chart 18



EURIBOR-OIS spread

The difference between EURIBOR and OIS (the EURIBOR-OIS spread) is an indicator used for risk assessment in the eurozone interbank market (see annex B.22).¹¹¹ The

¹⁰⁸ A detailed analysis of risk drivers is possible based on aggregate sub-indicators calculated for each of the seven aforementioned risk categories; see Deutsche Bundesbank (2013a).

¹⁰⁹ Recommendation D.2 b) in ESRB (2014) refers to the ECB indicator for systemic stress as an example (CISS, see Holló et al., 2012). The stress indicator for the German financial system is highly correlated with CISS, but nevertheless focuses on the German financial sector.

¹¹⁰ The stress indicator scale ranges from 0 (historic low) to 1 (historic high). As a result, its current level should be interpreted in relation to its level at the height of the global financial crisis.

¹¹¹ The ESRB recommends the LIBOR-OIS spread as a good indicator of stress in the bank refinancing market; see Recommendation D.2 a) in ESRB (2014). Thornton (2009), for instance, explains the meaning of LIBOR-OIS spread. LIBOR denotes London Interbank Offered Rate. This is a benchmark rate for unsecured money market lending between the most important international financial institutions. EURIBOR is the eurozone equivalent to LIBOR that is used in this methodological framework. The OIS (Overnight Index Swap) refers to an interest rate swap transaction that exchanges a fixed interest rate for a variable interest rate. For the euro, the EONIA interest rate (Euro Overnight Index Average) is used as the variable benchmark interest rate. It is the interest rate calculated by the ECB for unsecured overnight lending between banks in the eurozone.

Indicators for assessing the CCB rate in Germany

spread mainly reflects two components – a default risk premium and a liquidity premium.¹¹² The default risk is low when entering into an OIS transaction, because the transaction only covers the difference between a fixed rate and a variable rate, and does not affect the principal. As a result, the difference between the EURIBOR and the OIS should be closely related to the default premium. Chart 19 shows that the indicator increases sharply and abruptly at the first signs of the global financial crisis in August 2007, whilst it reaches its historic high after the collapse of Lehman Brothers in October 2008.

Chart 19



Average CDS spread for German banks

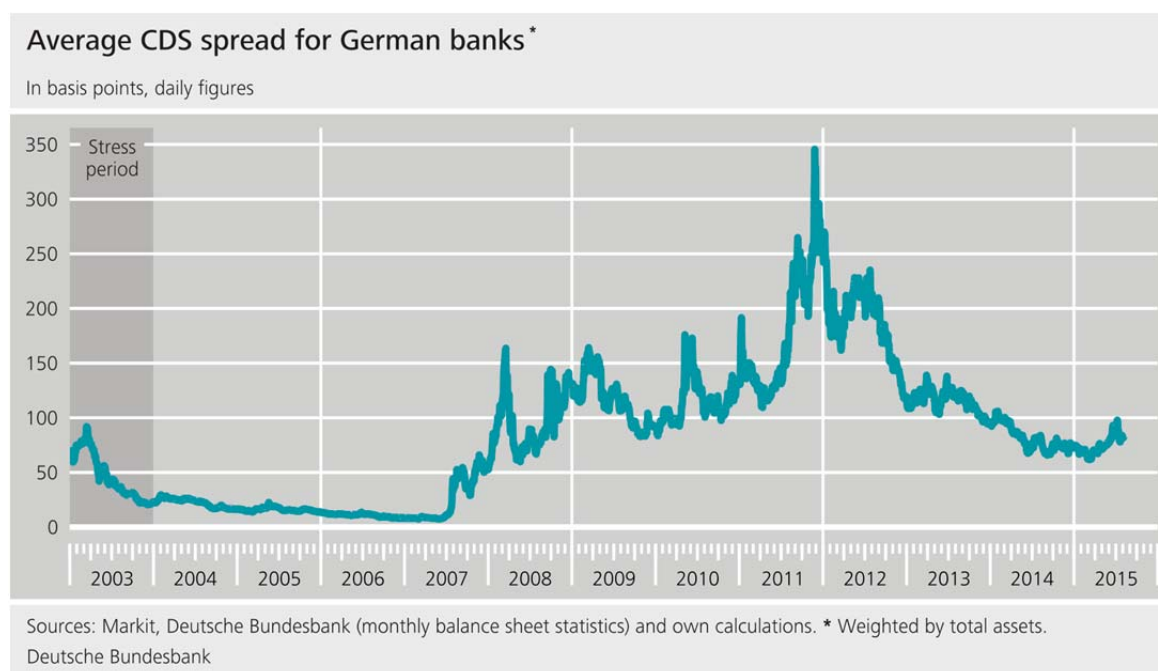
To assess German banks' default risk, their average CDS spread weighted by total assets is calculated (see annex B.23). An increase in the average CDS spread signals rising concerns by market participants about the default risk associated with the banks. In addition to the substantial increase during the global financial crisis and the subsequent European debt crisis, the figures were at elevated levels in 2003, the last year of the identified stress period (chart 20). This illustrates the added value of this indicator compared to the EURIBOR-OIS spread, which focuses on the eurozone. It is capable of signalling an increase in default premiums specifically in the German banking sector. However, this is not a comprehensive indicator, because CDS spreads are available only for a limited number of large institutions.¹¹³

¹¹² See, e.g., Filipovic (2012).

¹¹³ Currently nine banks, which represent around 40 % of the German banking system (measured by total assets).

Indicators for assessing the CCB rate in Germany

Chart 20



4.4 Gradual and prompt release of the buffer

Essentially, there are two reasons for releasing the buffer that has previously been built up: first, a decrease in identified risks, and second, the realisation of risks in the form of losses. In the first scenario, it may be advisable to release the buffer gradually if the identified systemic risk recedes and lending returns to normal. The decisions should be based on the overall risk assessment that includes the whole set of indicators presented in this document. By contrast, a prompt release of the buffer should be considered in the second scenario.

The credit-to-GDP gap is not a suitable indicator to use when deciding whether to promptly release the buffer. The underlying data are only available after a period of time has elapsed. Additionally, as in the case of credit aggregates, information incorporated in the data may show a lagging trend. Consequently, the credit-to-GDP gap does not immediately indicate the beginning of a stress period. For this, other indicators take precedence – above all financial market indicators, which are available in real time. Aside from the EURIBOR-OIS spread and the CDS spread for German banks, relevant variables include indicators of the potential mispricing of risk, in particular the implicit volatility of the DAX. According to empirical studies, these indicators can signal stress in the banking sector in a timely manner.¹¹⁴ Here, the assessment is supported by the stress indicator for the German financial system, which is only available on a monthly basis.

Overall, the financial market indicators help to judge whether there is currently stress in the banking sector or in the financial markets, which may point to a looming credit

¹¹⁴ Detken et al. (2014) conclude that for EU member states, the LIBOR-OIS spread in particular is a good indicator for prompt release (for the USA, see IMF, 2011, p. 21). In addition, the average bank CDS spread and the ECB indicator for systemic stress (CISS) perform well. It should be noted, however, that for reasons relating to data availability, the evaluation mainly refers to the global financial crisis. Moreover, volatility is an integral part of various financial market stress indicators, such as the CISS.

Final remarks

crunch. However, they will not automatically lead to the release of the CCB. On the one hand, as mentioned above, data such as CDS spreads are only available for a limited number of big banks. As a result, they are not sufficient to provide a full picture of potential stress throughout the entire domestic banking system consisting of around 1,800 banks.¹¹⁵ On the other hand, the date on which the stress indicators raise the alarm does not have to coincide with the date on which the risks or losses which the capital buffer was built up to contain actually materialise. Therefore, additional useful variables are bank soundness indicators, in particular data on non-performing loans. Of course, these are only available with a delay and may also have a lagging trend. In addition, indicators based on the growth in bank credit, as well as the net interest spread, may be used.¹¹⁶ Finally, aside from “hard” indicators, qualitative information, such as survey data and the results of relevant stress tests may play a role in deciding whether to release the buffer.

5 Final remarks

The CCB will be introduced in Germany on 1 January 2016. The analytical framework presented here will help to set the appropriate buffer rate on a quarterly basis. The introduction of the tool in 2016 should not be confused with its activation for domestic credit exposure (i.e. setting a buffer rate greater than zero). The domestic buffer should only be activated if and when excessive credit growth in the domestic private non-financial sector is associated with the build-up of systemic risks. For these purposes, the situation will be assessed using the credit-to-GDP gap and other indicators.

The credit-to-GDP gap determines the buffer guide, which represents the rule-based component for the decision regarding the buffer rate. In addition, other quantitative indicators and qualitative assessments will help in setting an appropriate buffer rate. Therefore, there is discretionary leeway. Setting the buffer rate is therefore a rule-guided discretionary decision. The reason for the supervisory authority to exercise discretion is that, to date, it is impossible to implement strictly binding rules. In the area of financial stability (unlike in monetary policy), there is no straightforward, quantitative target value and no single reliable indicator for activating the CCB and adjusting its level.

Because the CCB is a new macroprudential policy tool, empirical evidence of its effectiveness still has to be collected. Moreover, in this regard, future changes in CCB-related procedures agreed in Europe and internationally cannot be ruled out. Therefore, the analytical framework described in this paper will be reviewed and updated if necessary. Finally, the basis for dealing with foreign buffer rates for major risk exposure in other countries is still under development. It will take into account the results of the analysis on this issue currently being conducted at the European level.

¹¹⁵ As at the end of 2014.

¹¹⁶ See Drehmann et al. (2011), Giese et al. (2014) and BoE (2014).

Annex A Review of the credit-to-GDP gap

Annex A Review of the credit-to-GDP gap

From a theoretical and empirical standpoint, the credit-to-GDP gap is a suitable indicator for the CCB. It shows to what extent loans historically grow faster than GDP. Therefore, in empirical analyses, it often demonstrates good early-warning properties,¹¹⁷ which supports the use of this indicator for the CCB build-up phase.

However, when using the indicator, misleading signals cannot be ruled out. On the one hand, a statistically calculated trend cannot always deal cleanly with structural changes.¹¹⁸ On the other hand, loans and GDP may develop in an asynchronous manner, which may result in misleading signals. For example, a large, positive credit-to-GDP gap may arise during an economic downturn merely because GDP decreases, although lending is still increasing (e.g. because credit lines that have already been approved are drawn down). In this case, the credit-to-GDP gap sends a misleading signal to further build up the CCB.¹¹⁹ In this regard, Repullo and Saurina (2011) object that the credit-to-GDP gap is often negatively correlated with GDP growth, which in their view would lead to the CCB having a pro-cyclical effect. However, Drehmann and Tsatsaronis (2014) refute this claim. They find a positive correlation in relevant periods if the buffer ought to have been built up in the past. This is in line with the intended use of the indicator. Chart 21 illustrates that in terms of building up the buffer, the relevant periods are those in which positive GDP growth is accompanied by a credit-to-GDP gap that is above the activation threshold (as in the second half of the 1990s in Germany).

There are several options for calculating the trend which influence the results. For example, the smoothing parameter for the HP filter is not estimated, but instead is determined exogenously. Here, the BCBS (2010b) proposes a smoothing parameter of 400,000. This selection is justified as follows. The starting point is the smoothing factor of 1,600 normally used in economic research for GDP data made available on a quarterly basis.¹²⁰ This is for a cycle lasting up to 7 or 8 years. Based on the assumption that a credit cycle is about four times longer than the business cycle, a conversion formula yields a smoothing parameter of around 400,000.¹²¹ The use of smaller smoothing parameters would be associated with more frequent swings, the amplitude of which would, however, tend to be lower (see chart 22). If the thresholds for calculating the buffer guide were lowered accordingly, this would lead to more frequent misleading signals on buffer activation.¹²²

¹¹⁷ Detken et al. (2014, pp. 6-7) provide an extensive overview of the literature on this issue.

¹¹⁸ For that reason, the credit-to-GDP gap yields worse results for Central and Eastern European countries undergoing transformation, for example, whose financial markets developed rapidly during the transition from a planned economy to a market economy in the 1990s; see Geršl, A. and J. Seidler (2011).

¹¹⁹ See also section 4, Principle 3 BCBS (2010b) and Recommendation A, Principle 3 in ESRB (2014).

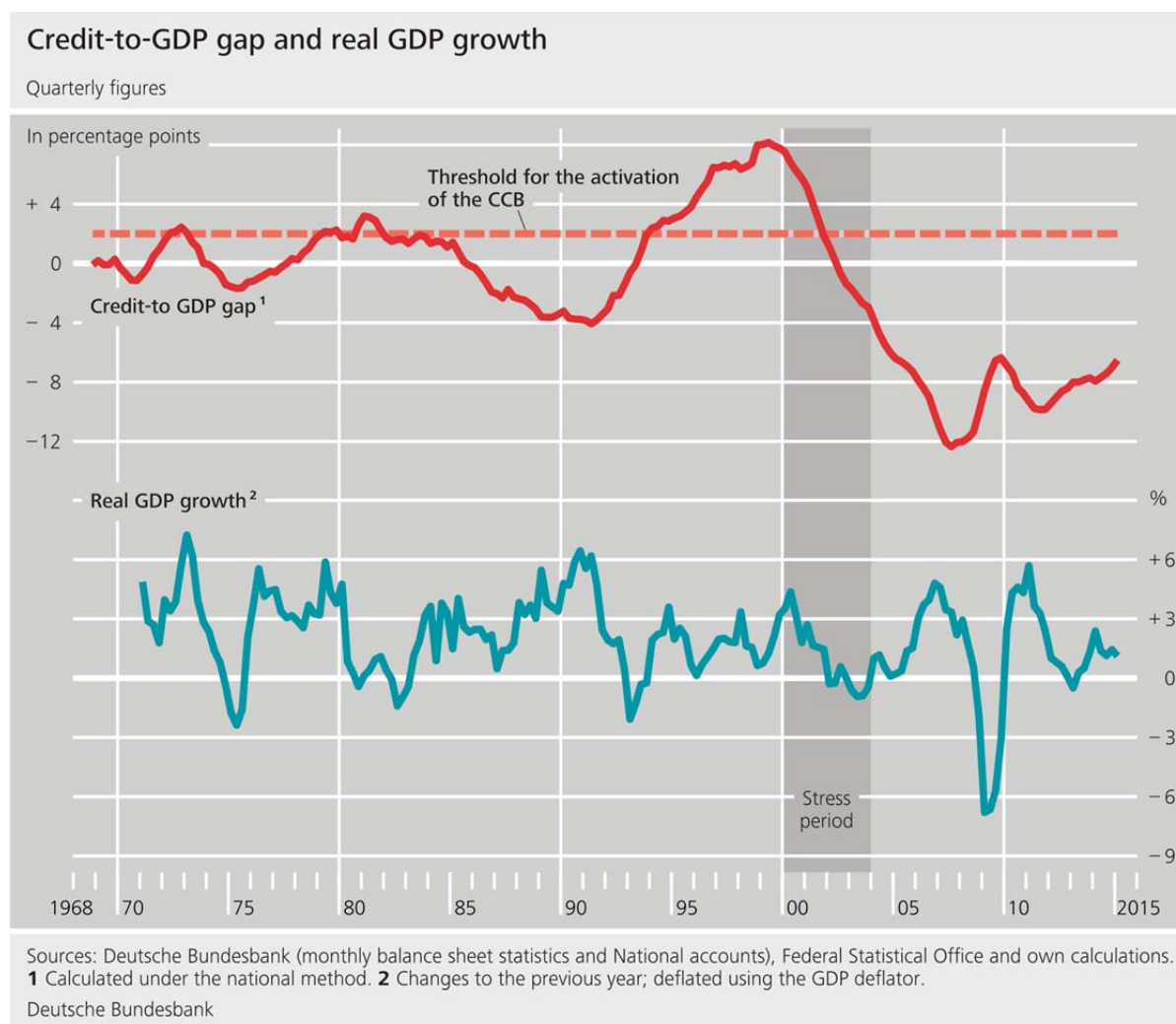
¹²⁰ See Hodrick and Prescott (1981).

¹²¹ Ravn and Uhlig (2002) show that, to convert the smoothing parameter to cycles with other durations, the 1,600 figure must be multiplied by the fourth power of the respective observation frequency (4 for quarterly observations). The conversion $1,600 \times 4^4$ gives 409,600 or approximately 400,000.

¹²² Adjustment of the thresholds is also an issue when calculating the buffer guide under the national method. In that case, bank loans represent only a portion of total debt of the domestic private non-financial sector. Consequently, the variance in the credit-to-GDP ratio is smaller than in the standardised calculation, and it becomes less likely that the credit-to-GDP gap will exceed the thresholds of 2 % and 10 % proposed in Basel (2010b). This suggests a downward adjustment of the thresholds. Practical implementation of such an adjustment, however, is difficult for at least two reasons. First, ex-post sample calculations of the buffer guides show that for smaller thresholds, the number of false alarms increases significantly. Second, there is a risk of

Annex A Review of the credit-to-GDP gap

Chart 21



An HP filter will revise the trend previously calculated as soon as new observations are added. Among other things, this means that the credit-to-GDP gaps calculated using recursive and non-recursive filtering differ significantly from one another.¹²³ Nevertheless, the credit-to-GDP gap calculated almost in real time with the recursive filter has better early-warning properties and is therefore more appropriate for the purposes of the CCB.¹²⁴ Another source for trend revision is the ex-post revision of the underlying data. Basically, this problem exists for all data and cannot be eliminated. Nonetheless, this will not necessarily have a negative impact on the early-warning properties of the credit-to-GDP gap.¹²⁵

overfitting if the new thresholds for Germany are calibrated based on only one crisis period. However, an adjustment of the thresholds may be considered in future if supported by the empirical evidence.

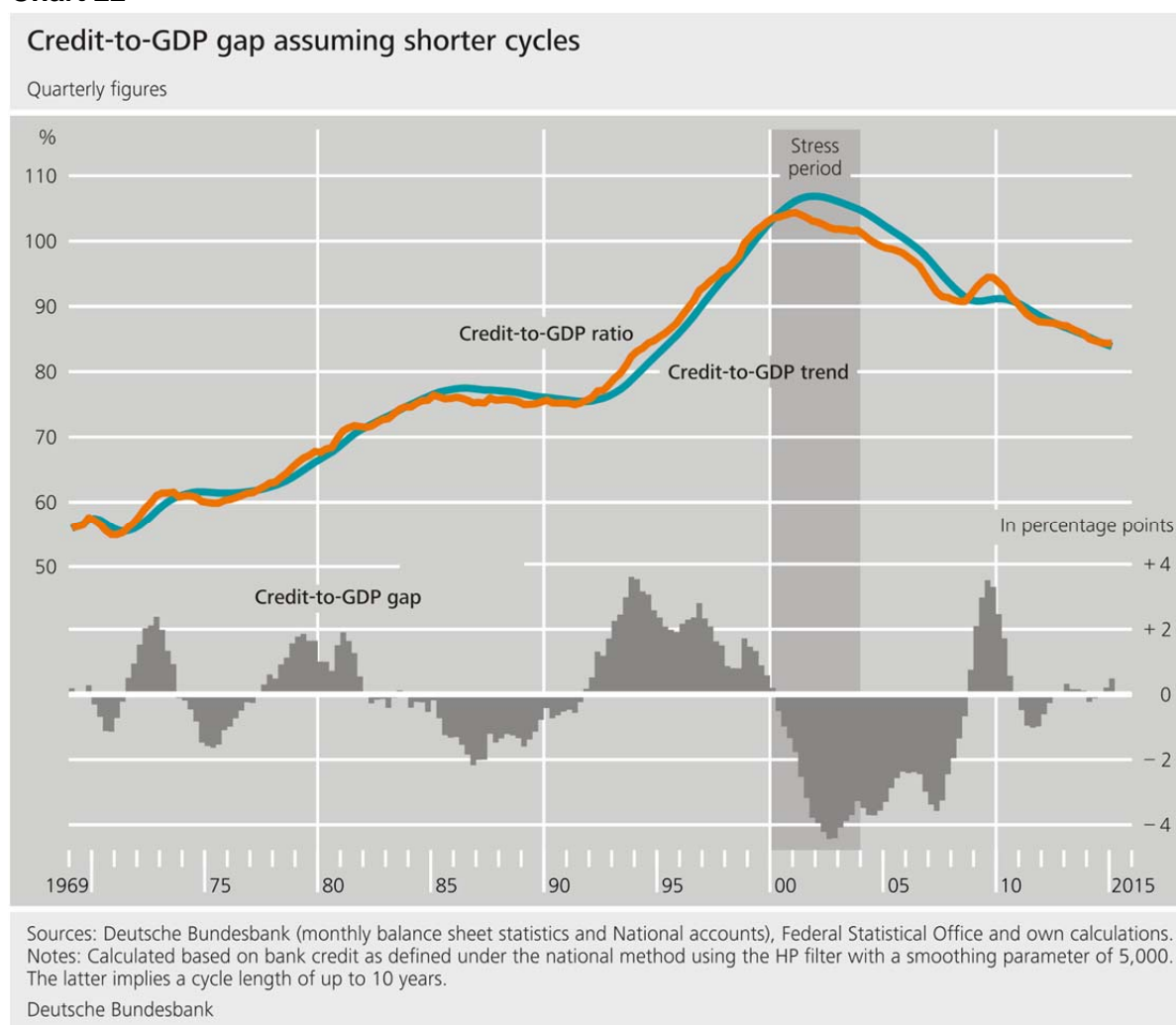
¹²³ See Edge and Meisenzahl (2011). Under non-recursive filtering, the trend for the entire time series is calculated. Under recursive filtering, by contrast, the trend is calculated and saved initially only for a few observations at the beginning of the time series. Subsequently, additional observations are added, one-by-one, and only the final value of the trend calculated in this manner is saved. This makes it possible to reproduce a quasi-real-time calculation of past values.

¹²⁴ See Drehmann et al. (2011, pp. 23-24) and van Norden (2011).

¹²⁵ See Giese et al. (2014).

Annex A Review of the credit-to-GDP gap

Chart 22



The filter attributes a higher weight to end point observations (the so-called “end point problem”).¹²⁶ If the underlying time series ends close to its cyclical high, the filter will bias the trend upwards. By contrast, near the low point, the trend will be biased downwards. Therefore, at the current end point on the chart, projections or forecasts of the future trend could be relevant.¹²⁷ The same applies at the beginning of the time series, meaning that the situation at the starting point strongly influences the credit-to-GDP gap in the first years of observation and in the case of shorter time series.¹²⁸

Data quality is a general problem that can affect the usefulness of every indicator. With shorter time series, e.g. if the data go back only 20 years, the long-term trend for the credit-to-GDP ratio cannot be reliably calculated. The same problem may arise with longer time series if they include large statistical breaks. It is therefore important for the underlying time series to be as long as possible and free of statistical breaks.

Finally, aside from the HP filter, there are other statistical methods for breaking a time series down into cyclical and trend components. An easy, common alternative would be

¹²⁶ See Deutsche Bundesbank (2013b).

¹²⁷ See Norges Bank (2013) and Gerdrup et al. (2013).

¹²⁸ See Geršl and Seidler (2011).

Annex A Review of the credit-to-GDP gap

to calculate a moving average over several years.¹²⁹ On the other hand, the HP filter is merely a special case of the so-called high-frequency filter.¹³⁰ The high-frequency filter is permeable to all cyclical fluctuations whose frequency is higher than a specific, pre-defined value. In practice, however, a band-pass filter (e.g. the Christiano-Fitzgerald filter) is more useful. As the name implies, the band-pass filter specifies a range of frequencies that will be included in the calculation of the cyclical component (i.e. not just an upper limit, but also a lower limit). As a result of the lower limit, short-term fluctuations are filtered out and the cyclical component is “smoothed”.¹³¹

However, applying the HP filter in accordance with the Basel proposal, the indicator demonstrates good signalling properties which are not significantly improved upon by any of the alternative specifications reviewed.¹³² This showed calculations based on data from Detken et al. (2014) for EU-28 using the following alternative specifications:

- HP filter with smaller smoothing parameter;
- Christiano-Fitzgerald filter, moving average;
- Recursive and non-recursive filtering;
- Filtering using a projected credit-to-GDP time series.

These results also apply to German data (see chart 23 for bank credit). Consequently, the same HP filter specification as that recommended in BCBS (2010b) is used for calculating the credit-to-GDP gap in Germany, i.e. the recursive HP filter with a smoothing parameter of 400,000 and without any projections of the underlying time series.

¹²⁹ For example, over 10 years in Norges Bank (2013) and over 20 years in Giese et al. (2014).

¹³⁰ See Edge and Meisenzahl (2011).

¹³¹ For example, the National Bureau of Economic Research uses the band-pass filter to calculate business cycles; only cyclical fluctuations in the frequency domain between 6 and 32 quarters are examined; see Baxter and King (1995).

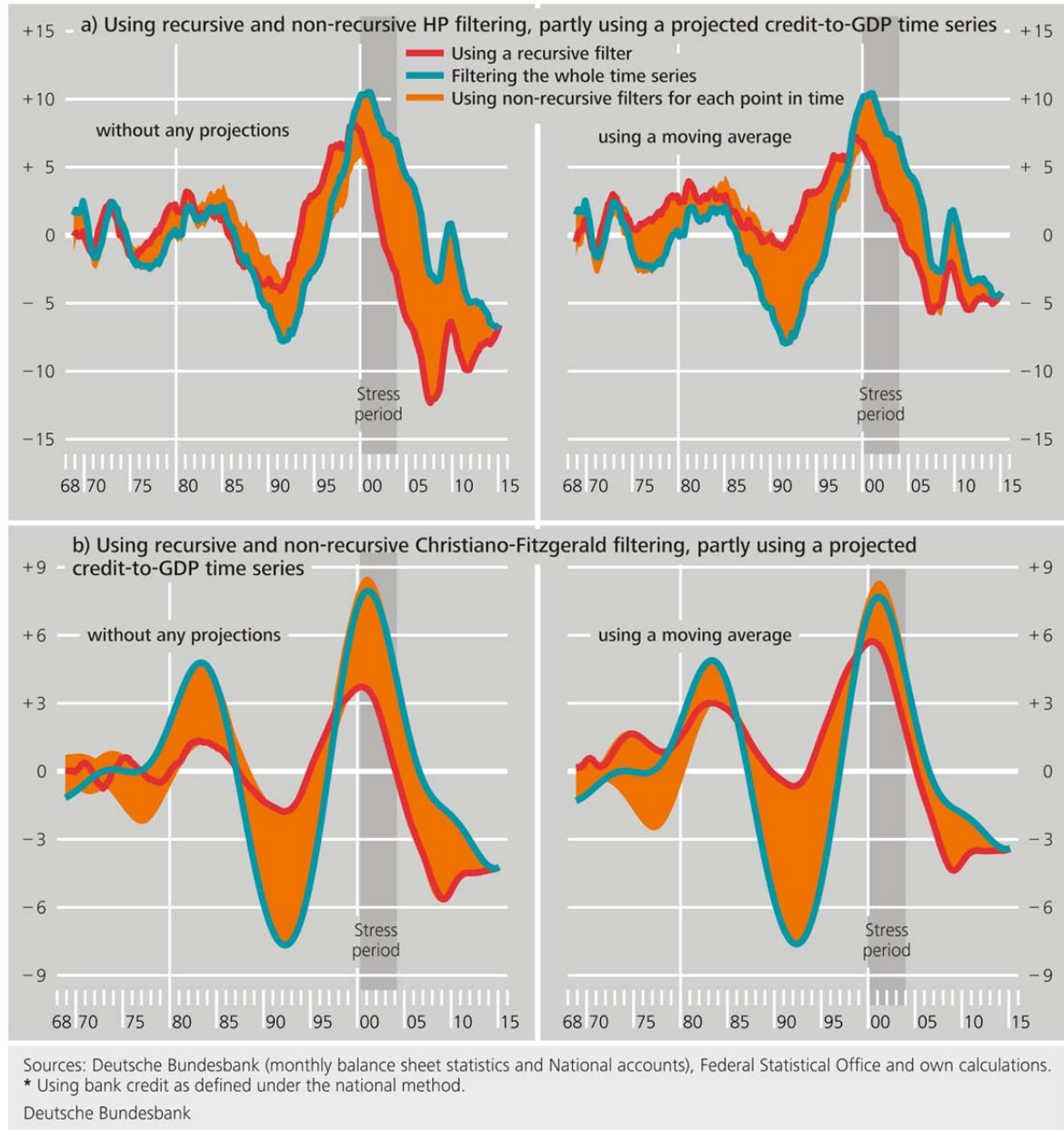
¹³² See also Detken et al. (2014, p. 28).

Annex A Review of the credit-to-GDP gap

Chart 23

Revision in the credit-to-GDP gap: comparison of methods*

In percentage points



Annex B Data description

Annex B Data description

B.1. Total debt of the private non-financial sector

Definition: Consolidated debt of domestic non-financial corporations, excluding equity securities and insurance technical reserves, and unconsolidated debt of economically independent, economically dependent and other private individuals and non-profit institutions serving households. Amount at end of quarter.

Creditors: “Rest of the world”.

Data sources: National financial accounts; prior to 1991 approximated using data from the monthly balance sheet statistics.

Data availability: In general, the data are available on a quarterly basis from the fourth quarter of 1968 onwards, with a delay of around 3.5 months. However, national financial account data compiled according to the European system of national and regional accounts (ESA) are available only from the first quarter of 1991 onwards.

Statistical breaks: Transition from West Germany to the re-united Germany in the first quarter of 1991. Simultaneous transition to the national financial account statistics prepared in accordance with ESA '95. Transition to the national financial account statistics prepared in accordance with ESA 2010 accounting standards in the first quarter of 1999.

Other distinctive features: For the period from 1968 to the end of 1990, the data that were available only on an annual basis were compiled using the best possible approximation to the definition specified in ESA '95. The temporal disaggregation procedure proposed by Chow and Lin (1971) was then applied to the annual data.¹³³ Loans from the monthly balance sheet statistics that were used to calculate the national credit-to-GDP gap served as the benchmark time series. No information is available prior to 1991 on foreign sources of financing for economically independent, economically dependent and other private individuals and non-profit institutions serving households.

Adjustment: The time series is seasonally adjusted (using a method applied for the purposes of the CCB).

B.2. Bank credit to the private non-financial sector

Definition: Loans and discount credits from domestic banks to domestic non-financial corporations, economically independent, economically dependent and other private individuals and non-profit institutions serving households, and debt securities from domestic non-financial corporations. Amount at end of quarter.

Creditors: Domestic monetary financial institutions (banks and money market funds).

Data sources: Monthly balance sheet statistics, supplemented by building societies data and capital market statistics on money market funds.

Data availability: The data are available on a monthly basis from the fourth quarter of 1968 onwards, with a delay of around 1.5 months. Money market fund data are available from the third quarter of 1997 onwards. During the period from 1968 to the end of 1998, monthly

¹³³ Following the approach of the Bank for International Settlements (BIS) for compiling the database for long time series on credit and debt; see Dembiermont et al. (2013, p. 69) and BIS (2015).

Annex B Data description

balance sheet data are supplemented with building societies loans to households. The data on building societies loans to production companies that were available only on an annual basis during this period were disregarded due to the small amounts (prior to 1985; afterwards equal to zero). Since 1999, building societies have belonged to the monthly balance sheet statistics reporting group.

Statistical breaks: Transition from West Germany to the re-united Germany in the second quarter of 1990; for building societies statistics, not until the fourth quarter of 1990. Separation of building societies from the non-financial corporations sector in the first quarter of 1999.

Other distinctive features: The national credit-to-GDP gap is based on the sum of changes in the outstanding amount of loans and securities plus the stock of loans and securities at the end of the fourth quarter of 1968. The time series of changes in the outstanding amount has been adjusted for statistical changes. For this reason, the sum of changes in the outstanding amount does not match the actual stock of loans and securities at the end of a given observation period. Therefore, the time series on the actual outstanding amount of loans and securities is used to assess the actual level of bank credit relative to the GDP (i.e. the credit-to-GDP ratio as an indicator in the category “Bank credit and total debt”).

Adjustment: The underlying time series have been seasonally adjusted.

B.3. Gross domestic product for calculating the standardised credit-to-GDP gap

Definition: Nominal gross domestic product. Four-quarter moving sum.

Data source: Federal Statistical Office, Wiesbaden (original values), National accounts.

Data availability: The data are available on a quarterly basis from the first quarter of 1960 onwards, with a delay of around 1.5 months.

Statistical breaks: From 1960 to the end of 1969, data were compiled according to ESA '75; from 1970 to the end of 1990, data were compiled according to ESA '95; since 1991, data have been compiled according to ESA 2010. Transition from West Germany to the re-united Germany in the first quarter of 1991.

Other distinctive features: Due to summation, each statistical break extends over several quarters. Therefore, a correction was made to the period relating to the statistical break for German re-unification. It ensures that the break takes place in the first quarter of 1991. GDP data compiled according to ESA '95 were used until the end of 1998 (for the sake of consistency with the national financial accounts).

Adjustment: The underlying time series have been calendar and seasonally adjusted.

B.4. Gross domestic product for calculating the national credit-to-GDP gap

Definition: See annex B.3.

Data source: See annex B.3.

Data availability: See annex B.3.

Statistical breaks: See annex B.3.

Other distinctive features: In order to ensure consistency with the time series for the bank credit, the GDP time series was rescaled upwards mechanically before the second quarter of

Annex B Data description

1990. The constant scaling factor applied is based on the hypothetical GDP share of East Germany that amounts to 7.8 % in 1991 and for which a parallel account is available.

Adjustment: See annex B.3.

B.5. Real growth in gross domestic product

Definition: Gross domestic product at chain-linked previous-year prices (base year 2010); change to the previous year.

Data source: Federal Statistical Office, Wiesbaden (original values), National accounts.

Data availability: The data are available on a quarterly basis from the first quarter of 1971 onwards, with a delay of around 1.5 months.

Statistical breaks: From 1971 to the end of 1990, data were compiled according to ESA '75; from 1970 to the end of 1990, data were compiled according to ESA '95; since 1991, data have been compiled according to ESA 2010. Transition from West Germany to the re-united Germany in the first quarter of 1991.

Adjustment: The underlying time series have been calendar-adjusted only.

B.6. GDP deflator

Definition: The GDP price index from the base year of 2010.

Data source: Federal Statistical Office, Wiesbaden (original values), National accounts.

Data availability: The data are available on a quarterly basis from the first quarter of 1960 onwards, with a delay of around 1.5 months.

Statistical breaks: See annex B.3.

Other distinctive features: Conversion of the underlying partial time series to the base year of 2010.

Adjustment: The underlying time series have been seasonally adjusted.

B.7. Net interest spread

Definition:

The net interest spread is equal to the average lending rate minus the banks' refinancing rate.

- **Lending rate:** The volume-weighted lending rate is calculated from the interest on loans to non-financial corporations and households. It covers only new lending business. The interest rate for households includes three categories: housing loans, consumer loans and other loans.
- **Refinancing rate:** The banks' refinancing rate is weighted according to maturity, i.e. it is calculated from the refinancing rates over the remaining time to maturity of the loans. A synthetic liabilities side is constructed with a maturity structure that matches the maturity classes of the loans extended. Two maturity classes are examined – loans with a remaining time to maturity of 1 to 5 years and loans with a remaining time to maturity of more than 5 years. For loans with a remaining time to maturity of 1 to 5 years, the average interest on bank debt securities with a remaining time to maturity of 1 to 5 years is determined. For loans with a remaining time to maturity of more than 5 years, the average interest on bank debt securities with a remaining time to maturity of 5 to 10 years

Annex B Data description

is determined. Loans with a remaining time to maturity of up to 1 year are not examined. Due to their shorter terms, they are rolled over more frequently and are represented in the new lending business far more frequently than one would expect from the outstanding amounts.

Data sources: MFI interest rate statistics and capital market statistics.

Data availability: The MFI interest rate statistics are available from 2003 (monthly).

B.8. Growth in residential real estate prices

Definition: Residential real estate prices are based on chain-linked indices.

Data source: Deutsche Bundesbank calculations on the basis of data provided by bulwiengesa AG and vdpResearch GmbH.

Data availability: Yearly data from 1976 to 2006. Quarterly data from 2007 onwards.

Statistical breaks: From 1976 to 2005, the data relates to owner-occupied apartments and terraced houses (bulwiengesa AG).¹³⁴ From 2006 onwards, residential real estate prices relate to owner-occupied housing in administrative districts (*Landkreise*) and autonomous cities (*kreisfreie Städte*) (vdpResearch GmbH).

B.9. Price-adjusted growth in housing loans

Definition: Growth (p.a.) in housing loans to households and corporations. Creditors are domestic monetary financial institutions. Credit growth is adjusted using the consumer price index.

Data sources: Bundesbank (borrower statistics) and Federal Statistical Office, Wiesbaden.

Data availability: Quarterly data from 1968 onwards.

Statistical breaks: From June 1990 incl. loans from East German banks. Up to December 1998 incl. loans on a trust basis; from 1999 onwards, loans on a trust basis are no longer included in loans.

Adjustment: Annual growth rates calculated on the basis of changes in the outstanding amount of loans that have been adjusted for statistical changes.

B.10. Lending standards for housing loans

Definition: Development of lending standards for housing loans to households in the past three months. Unweighted changes, i.e. percentage of banks which have tightened standards for housing loans, minus the percentage of banks which have eased standards.

Data sources: Bank Lending Survey, question 10, sub-question 1.

Data availability: The data are available from the first quarter of 2003 onwards.

B.11. Current account balance

Definition: Current account balance (four-quarter moving sum).

¹³⁴ 1976-1989: owner-occupied apartments and terraced houses, first occupancy (50 cities in West Germany, incl. West Berlin). 1990-1994: all owner-occupied apartments and terraced houses (100 cities in West Germany, incl. West Berlin). 1995-2005: all owner-occupied apartments and terraced houses (125 large cities).

Annex B Data description

Data source: Balance of payments statistics.

Data availability: The data are available on a monthly basis from 1971 onwards.

Statistical breaks: Transition from West Germany to the re-united Germany in July 1990. Data prior to 1991 according to the international standards stipulated in the fifth edition of the IMF's Balance of Payments Manual; data since January 1991 according to the international standards stipulated in the sixth edition of the IMF's Balance of Payments Manual.

Adjustment: The time series is seasonally adjusted.

B.12. DAX 30 price index return

Definition: Percentage change (p.a.) in the DAX 30 price index. Calculation for month-end levels.

Data sources: Thomson Reuters Datastream.

Data availability: The underlying data are available from December 1987 onwards.

Statistical breaks: Changes in the composition of the index.

B.13. VDAX New Volatility Index

Definition: The VDAX shows the implied volatility of the 30 German blue chip shares comprising the DAX. The volatility index is calculated on the basis of the corresponding index options traded on the Eurex derivatives exchange. The index has a fixed time to maturity of 30 days and covers both DAX options that are "at the money" and those that are "out of the money". It is listed in annualised form.

Data sources: Thomson Reuters Datastream.

Data availability: The data are available on a daily basis from January 1992 onwards.

Statistical breaks: Changes in the composition of the index.

B.14. Real interest rate

Definition: The real interest rate is measured using the yield on 10-year German government bonds minus estimated inflation over that time period.

Data sources: Deutsche Bundesbank and Consensus Economics.

Data availability: The data are available on a monthly basis from October 1989 onwards.

B.15. Spread on yields of BBB-rated corporate bonds

Definition: The yield premium is equal to the difference between (1) the iBoxx Euro Non-Financials Bond Index for BBB-rated bonds with a remaining time to maturity of 7 to 10 years and (2) the iBoxx Euro Sovereign Germany Bond Index. The iBoxx Euro Non-Financials Bond Index includes fixed-rate, euro-denominated securities of non-financial corporations. The iBoxx Euro Sovereign Germany Index includes fixed-rate, euro-denominated German government bonds.

Data sources: Thomson Reuters Datastream.

Data availability: The data are available on a daily basis from July 2006 onwards.

Annex B Data description

B.16. Debt service ratio

$$\text{Definition: } DSR_t = \frac{i_t D_t}{(1 - (1 + i_t)^{-s_t}) Y_t}$$

Debt D_t :

- Total debt service ratio: Bank credit to the private non-financial sector (see B.2).
- Debt service ratio for households: Bank credit to households and non-profit institutions serving households.
- Debt service ratio for private non-financial corporations: Bank credit (including debt securities) to other domestic companies.

Income Y_t :

- Total debt service ratio: Gross domestic product; quarterly figures; (see B.3; “other distinctive features” not applicable).
- Debt service ratio for households: Disposable income, including adjustment for the change in the net equity of households in pension fund reserves.

Data source: Federal Statistical Office, Wiesbaden (original values before seasonal adjustment).

Data availability: The data are available on a quarterly basis from the first quarter of 1991 onwards, with a delay of 2 months.

Statistical breaks: Territorial status – from 1991 onwards, Germany; prior to that, West Germany. Chain-linked annual average for 1991 (own calculation).
Methodology: Data are annual overlap chain-linked Laspeyres indices. Data sources: From 1970 to 1990 according to ESA '95; from 1991 onwards according to ESA 2010.

Adjustment: The time series is seasonally adjusted.

- Debt service ratio for private non-financial corporations: Corporate/entrepreneurial income approximated via the time series for corporate/entrepreneurial and property income in current prices.

Data source: Federal Statistical Office, Wiesbaden (original values before seasonal adjustment).

Data availability: The data are available on a quarterly basis from the first quarter of 1991, with a delay of 2 months.

Statistical breaks: Territorial status – from 1991 onwards, Germany; prior to that, West Germany. Chain-linked annual average for 1991 (own calculation).
Methodology: Data are annual overlap chain-linked Laspeyres indices. Data sources: From 1970 to 1990 according to ESA '95; from 1991 onwards according to ESA 2010.

Adjustment: The time series is seasonally adjusted.

Average interest payable i_t prior to 2003:

No comprehensive interest rate time series exist for the private non-financial sector in Germany before 2003. Therefore, an interest rate time series that broadly approximates the corresponding interest rates prior to 2003 is used for the household and corporate/entrepreneurial sector.

Annex B Data description

- Households:

Definition: German banks' lending rates for mortgage loans on residential properties at variable rates of interest, effective interest rate (average rate).

Data source: Bundesbank's interest rate statistics.

Data availability: Data are available on a monthly basis from June 1982 to June 2003.

Statistical breaks: To calculate the effective interest rate, a basic annual principal repayment rate of 1 % plus interest saved is assumed, taking into account the respective repayment methods agreed by the participating banks (up to January 1985, primarily quarterly payment and quarterly or annual crediting, as well as monthly payment and crediting; from February 1985 to December 1986, primarily quarterly payment with annual crediting, as well as monthly payment with monthly or quarterly crediting; from January 1987 onwards, primarily monthly payment and crediting, as well as quarterly payment and crediting; from January 1994 onwards, primarily monthly payment and crediting). From the reporting month of September 2000 onwards, the effective interest rate is calculated in accordance with the methodology of the ISMA (International Securities Market Association). Here, using the ISMA method (non-linear interest accruing in less than one year) tends to result in slightly lower effective annual interest.

- Private non-financial corporations:

Definition: German banks' lending rates for discount credits, bills eligible for rediscount with the Bundesbank up to less than EUR 50,000 (average rate).

Data source: Bundesbank's interest rate statistics.

Data availability: Data are available on a quarterly basis from the second quarter of 1967 and on a monthly basis from February 1975 up to and including June 2003.

Statistical breaks: Survey ended in November 1970, immediately before the reduction in the bank rate. Since January 1991, rates of banks in the new German states have also been included in the interest rate survey. Up to and including May 1986: bills eligible for rediscount with the Bundesbank from DM 5,000 up to less than DM 20,000; from June 1986 up to and including December 2001: bills eligible for rediscount with the Bundesbank up to less than DM 100,000.

Average interest payable i_t from 2003 onwards:

Definition: Volume-weighted interest rate from interest rate for households and interest rate for non-financial corporations. Here, the interest rate for outstanding loans granted in the past periods as well as the interest rate for new lending are taken into account through appropriate weighting.

Data source: MFI interest rate statistics.

Data availability: Data are available on a monthly basis from January 2003 onwards, with a delay of around 4 weeks.

Statistical breaks: In 2010, the bank sample was expanded.

Other distinctive features: Because the interest rates are annual interest rates, the formula multiplies them by 0.25 so they can be shown on a quarterly basis.

Annex B Data description

Average remaining time to maturity s_t :

The average remaining time to maturity is approximated through the average loan term. To do this, only the data on loans granted in the past periods are used, because, in terms of new lending, it is impossible to differentiate with respect to maturity.

- From 2003 onwards, the average loan term is calculated as follows:

$$s_t = 4(a * 0.5 + b * 3 + c * 10),$$

where a denotes the ratio of the private non-financial sector's domestic loans with a maturity of one year or less to all loans to the domestic private non-financial sector; b is equal to the percentage of the private non-financial sector's domestic loans with a maturity of more than one year but less than five years; and c is the percentage of the private non-financial sector's domestic loans with a maturity of more than five years. For the three maturity categories, average remaining times to maturity of 0.5, 3 and 10 years, respectively, are assumed. Multiplying by four converts the annual figures into quarterly figures. When calculating the average loan terms for households and non-financial corporations, the same loan maturity categories are used with the corresponding shares of loans to the respective sectors.

- For reasons relating to data availability, no classification of loan terms is possible for the period before 2003. Average values from the period beginning in 2003 are used. For the entire domestic private non-financial sector, the average loan term is 33 quarters (standard deviation: 0.45). The average loan term is 36 quarters for the household sector (standard deviation: 0.31) and 28 quarters for the non-financial corporations sector (standard deviation: 0.88).

B.17. Tier 1 capital ratio

Definition: Tier 1 capital for solvency purposes as a percentage of banks' risk-weighted assets. Calculated in accordance with the regulatory requirements applicable in the respective period.

Data sources: Bank regulatory reporting (COREP; prior to that, German Solvency Regulation (SolvV); prior to that, Principle I (GS I)).

Data availability: The data are available on a quarterly basis from 1999 onwards; currently available 6 weeks after the respective reporting deadline.

Statistical breaks: 2007-2008 Introduction of the German Solvency Regulation (SolvV) (Basel II); from 2014, introduction of COREP (Basel III).

B.18. Unweighted capital ratio

Definition: Tier 1 capital for solvency purposes as a percentage of banks' total assets. Tier 1 capital is calculated in accordance with the regulatory requirements applicable in the respective period.

Data sources: Bank regulatory reporting (COREP; prior to that, German Solvency Regulation (SolvV); prior to that, Principle I (GS I)) and monthly balance sheet statistics.

Annex B Data description

Data availability: The data are available on a quarterly basis from 1999 onwards; currently available 6 weeks after the respective reporting deadline.

Statistical breaks: 2007-2008 Introduction of the German Solvency Regulation (SolvV) (Basel II); from 2014 introduction of COREP (Basel III).

B.19. Non-performing loans

Definition: Non-performing loans as a percentage of total gross loans to non-banks prior to deduction of risk provisions.

Data sources: Special data pursuant to the Audit Report Regulation (*Prüfungsberichtsverordnung: PrüfV*).

Data availability: The data are available yearly from 1999 onwards.

Statistical breaks: As part of the amendments to PrüfV in 2009, a new methodical data basis relating to the calculation of the relative non-performing loans was implemented for various items. This affected, in particular, data on the lending business, i.e. total credit exposure, loans to non-banks (previously gross recognition in each case, i.e. prior to deduction of impairment allowances, now net recognition, i.e. after deduction of impairment allowances) and credit risk provisions. Moreover, the definition of “credit” has changed fundamentally. The definition is no longer based on the German regulation on accounting principles relating to financial institutions and financial services institutions (*Verordnung über die Rechnungslegung der Kreditinstitute und Finanzdienstleistungsinstitute: RechKredV*), but rather on the meaning of article 19 of the German Banking Act (*Kreditwesengesetz: KWG*) (expanded definition of credit).

B.20. Loans with increased default risk

Definition: Loans with an increased default risk consisting of loans with an increased probability of default of 4 % or more that are not assigned to a default category, past due loans and loans for which individual value adjustments have been made, prior to deduction of individual value adjustments as a percentage of gross volume of loans to banks and non-banks.

Data sources: Special data pursuant to the Former Financial Information now also containing information on risk-bearing capacity (*Verordnung zur Einreichung von Finanz- und Risikotragfähigkeitsinformationen nach dem Kreditwesengesetz: FinaRisikoV*).

Data availability: The data are available on a quarterly basis from 2014 onwards.

B.21. Stress indicator for the German financial system

Definition: An aggregate time series depicting the stress situation in the German financial system. The stress indicator is compiled using a two-stage principal-component analysis of a total of 36 indicators from the fields of market, credit, contagion and sovereign risk, market and refinancing liquidity and macroeconomic environment indicators. In the first step of the procedure, an aggregate indicator is created for the seven categories. Stage two builds on this to create the overall indicator. See Deutsche Bundesbank (2013a).

Data sources: Bloomberg, ifo Institut, Markit, Thomson Reuters Datastream, ZEW Mannheim, Deutsche Bundesbank (aggregate bank regulatory reporting figures, statistical bank balance sheet data, macroeconomic time series).

Annex B Data description

Data availability: The aggregate time series is available on a monthly basis from September 2002 onwards.

Other distinctive features: Due to different frequencies in the underlying time series, some of them must be converted because the principal-component analysis applied assumes a common frequency of underlying data. Therefore, for daily data, end-of-month figures are used, whilst for time series with low frequencies, figures are interpolated and projected using autoregressive forecasts.

Statistical breaks: Liquidity data – Revision of the 2008 Liquidity Regulation (*Liquiditätsverordnung 2008*); statistical bank balance sheet data: 2010 German Accounting Law Modernisation Act (*Bilanzrechtsmodernisierungsgesetz 2010*).

B.22. EURIBOR-OIS spread

Definition: The difference between the 3-month EURIBOR interest rate (EUR003M index) and the EONIA-based 3-month OIS (EUSWEC currency).

Data source: Bloomberg.

Data availability: The data are available on a daily basis from January 1999 onwards.

B.23. Average CDS spread for German banks

Definition: Average CDS spreads (5-year, senior) of German banks weighted with total assets.

Data sources: Markit and monthly balance sheet statistics.

Data availability: CDS spreads are essentially available on a daily basis from 1 January 2003 onwards. Total asset figures are available on a monthly basis, generally with a delay of around 2 months.

Statistical breaks: The number of banks observed for which the CDS spreads are available vary over time.

Other distinctive features: Whilst the CDS spreads exhibit a daily frequency, the total asset figures are only available on a monthly basis. Therefore, the total assets figure is interpolated using the same value for every day of a given month. At the current end point of the time series, the last available figure is extrapolated accordingly.

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