THE ROLE OF THE LEVERAGE RATIO IN CAPITAL REGULATION OF THE BANKING SECTOR

Lukáš Pfeifer, Libor Holub, Zdeněk Pikhart, Martin Hodula

Basel III responded to the financial crisis by redefining and expanding the capital requirements for risk-weighted assets and by proposing the introduction of a leverage ratio setting a minimum level of capital for banks in relation to total exposures. The capital requirement is being increased primarily through the active use of macroprudential capital buffers. As a result, there have been proposals that the leverage ratio requirement should also take into account the level of capital buffers and thus become a macroprudential policy tool. One argument in support of such proposals is that if the level of capital buffers is not taken into account, the leverage ratio may not create a sufficient constraint on the size of banks’ exposures and hence not fulfil its intended purpose. This article examines the relationship between the capital and leverage ratios and discusses the options for, and effects of, introducing a macroprudential leverage ratio. We find that the capital and leverage ratios complement each other and that the introduction of a macroprudential leverage ratio could, under certain circumstances, enhance the effectiveness of macroprudential policy.

1. INTRODUCTION

The general objective of capital regulation is to increase banks’ resilience to unpredictable losses and to ensure that any losses they do incur are borne by their owners. This should ultimately curb risky behaviour by banks and hence also reduce the likelihood of crises in the banking sector. The CRD IV regulatory framework extends capital regulation to include macroprudential capital buffers, the application of which increases the banking sector’s resilience to systemic risks. However, experience has shown that capital based on risk-weighted assets may not be a sufficient guarantee of stability if the banking sector is excessively leveraged. The Basel Committee on Banking Supervision (BCBS) therefore came up with the concept of the leverage ratio. It abstracts from the various credit risk levels of different asset classes and links Tier 1 capital to total exposures, comprising total assets plus selected off-balance-sheet items.

In late 2010, the BCBS recommended a methodology for calculating the leverage ratio.2 The BCBS preliminarily set the minimum ratio (referred to here as the microprudential leverage ratio) at 3%, which limits the leverage of total exposures to 33.3 times Tier 1 capital. However, this may not be the final level, as the BCBS and the European Banking Authority (EBA) together with the European Commission (EC) have been tasked with reviewing the calibration of the microprudential leverage ratio by 2017. The microprudential leverage ratio is not a binding regulatory tool at the moment. However, the EU aims to make the leverage ratio a binding regulatory and supervisory tool as from 2018 (recitals 93–96 of the CRR).

There have also been proposals that the leverage ratio requirement should take into account the level of capital buffers and thus become a macroprudential policy tool. The European Systemic Risk Board (ESRB) mentions a macroprudential leverage ratio3 as a possible instrument for preventing excessive credit growth and leverage in one of its recommendations (ESRB, 2013) and describes it in more detail in ESRB (2015).

This article deals with the relationship between the leverage and capital ratios and the role of the leverage ratio in capital regulation of the banking sector.4 We begin by examining the nature of, and relationship between, the leverage and capital ratios. We then describe a possible setting of the macroprudential leverage ratio and its effect on the effectiveness of macroprudential policy. We go on to analyse the relationships between the two tools and selected financial indicators using data for types of Czech banks in 2002–2015. We end by assessing the impact of the level of, and changes to, risk weights on the leverage and capital ratios.

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2 The rules were later revised and are described in detail in BIS (2016a).
3 It has been introduced into national legislation for example in the UK (BoE, 2015).
4 This article does not set out to recommend a calibration or form of legislation for the leverage ratio.
2. THE RELATIONSHIP BETWEEN THE CAPITAL AND LEVERAGE RATIOS

Neither the form nor the calibration of the leverage ratio as a binding regulatory tool has been set definitively yet. The examples given in this article therefore serve to illustrate the importance of the leverage ratio as a supplementary tool in capital regulation of the banking sector and are based on the preliminary form described in ESRB (2015). Table 1 summarises the terms used in this article relating to the two capital regulation tools.\(^5\)

2.1 The capital ratio and the leverage ratio

The **capital ratio** is a capital regulation tool that reflects the riskiness of assets. It is based on the capital requirement,\(^6\) which is a function of the regulatory minimum capital ratio, the amount of assets and the risk weights of the relevant asset classes:

\[
RWR = \frac{K^{RWR}}{RWA}, \quad (1)
\]

\[
RWA = RW \cdot TA, \quad (2)
\]

which gives this formula for the capital requirement:

\[
K^{RWR} = (RW \cdot TA) \cdot RWR \quad (3)
\]

where \(RWR\) is the total capital ratio (%), \(K^{RWR}\) is the capital requirement implied by the total capital ratio, \(RWA\) are risk-weighted assets, \(RW\) is the average risk weight across all asset classes and \(TA\) are total assets.

The main advantage of the capital ratio is that it takes into account the riskiness of assets in relation to the bank’s business model. A bank that invests in higher-risk assets, which are generally associated with higher returns, should hold more capital than one that invests in less risky assets. CRD IV allows risk weights – and hence the riskiness of an asset – to be determined using either a standardised approach (STA) or an internal rating based approach (IRB). Banks applying the STA approach determine risk weights according to values laid down by law,\(^7\) whereas those using the IRB approach determine them using internal models. The main risk characteristics which determine the risk weights in banks’ IRB models are the probability of default (PD) and the loss given default (LGD).\(^8\)

The IRB approach is generally used to measure credit risk by large banks. Its advantages include greater sensitivity of the capital requirement to the risk structure of the bank’s assets. It tends to produce a lower risk weight for a given asset class than the STA approach.\(^9\) Given the complexity of the IRB approach, therefore, concerns have been expressed about the risk of insufficiently strict models, or “model risk” (Leslé and Avramova, 2012). Aikman et al. (2014a) assert that financial systems are better characterised by existing uncertainty than by assessment of frequently unpredictable risk. For this reason, they believe that complex approaches

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\(^5\) These terms are for reference only and should not be taken as binding, as some of them have yet to be incorporated into legislation because the regulatory process is still ongoing.

\(^6\) In this article we do not concern ourselves with the capital requirements for market risk and operational risk, which are based on other types of risks than credit risk. This is a simplification, as we work solely with the capital requirement for credit risk, which accounted for 87% of the total capital requirement as of 30 September 2015. We also use total risk exposures rather than risk-weighted exposures.

\(^7\) Under the STA approach, the asset class, its external rating and any collateral are taken into account when determining the risk weight. As of the end of 2015, the STA approach was being used to determine risk weights for 27.8% of total assets, so the IRB approach to determining credit risk was dominant.

\(^8\) Other variables enter the equation for the calculation of risk weights. For details, see Articles 153–154 of the CRR.

\(^9\) This is true for Czech banks (FSR 2014/2015, pp. 42–45).
should be complemented with simple yet comprehensive ones. The leverage ratio is an example of the latter.

The leverage ratio is a function of Tier 1 capital and total exposures, comprising total assets plus selected off-balance-sheet items:\(^{10}\)

\[
LR = \frac{K^{LR}}{TE},
\]

This gives us the following capital requirement calculation:

\[
K^{LR} = TE \cdot LR,
\]

where \(LR\) is the total leverage ratio (%), \(K^{LR}\) is the capital requirement implied by the total leverage ratio and \(TE\) are total exposures\(^{11}\) for the leverage ratio calculation.

The leverage ratio is therefore a (currently non-binding) capital regulation tool that does not reflect the riskiness of assets. Experience with the consequences of the recent financial crisis has shown that banks can record large losses even on assets that are generally regarded as low risk and have been assigned the highest rating (securitised assets and government bonds). Such assets have low risk weights and the capital requirement for them is therefore relatively low. Furthermore, a change in balance-sheet structure towards such assets allows banks to lower their capital requirements. However, the leverage ratio tool sets the capital requirement regardless of the riskiness of assets and thus defines the minimum absolute capital requirement. The risk of insufficient capital can therefore be mitigated by setting it at the right level. Introducing the microprudential leverage ratio implies setting the maximum leverage level. Juselius and Drehmann (2015) state that leverage, together with debt burden, is the main driver of the financial cycle. The main objective of introducing the leverage ratio is therefore to increase banks’ resilience to less likely losses due to credit risk and to reduce the probability and size of future financial crises. An improvement in financial stability thanks to the introduction of the leverage ratio is mentioned, for example, by Bair (2015) and Grill et al. (2015).

\[\text{Table 2 summarises the pros and cons of the capital and leverage ratios}\(^{12}\) and illustrates their complementary relationship, with the pros of one offsetting the cons of the other and vice versa. The leverage ratio to some extent mitigates the weaknesses of the capital ratio, such as modelling method complexity, model risk and procyclicality, which can lead to a lower capital requirement. Conversely, the capital ratio reduces the risk of funds being moved into riskier, higher-yield assets – a real risk if only the leverage ratio is in force. Setting a risk-weight floor in the IRB approach – currently under discussion in ongoing preparations to revise the approaches to determining risk weights (BIS, 2016b) – would have a similar effect as introducing a microprudential leverage ratio. This option may be more appropriate where model risk or systemic risk is associated with a specific asset class or sector. However, if those risks cannot be ruled out for other asset classes and other sectors, it may be simpler and more effective to use a leverage ratio than set risk-weight floors for multiple asset classes (for details, see ESRB, 2015, pp. 23–25).

\[\text{Source: Compiled by authors}\]

10 Besides total assets, total exposures partially include the values of derivatives and add-ons for counterparty credit risk of repurchase transactions, securities or commodities lending or borrowing transactions, long settlement transactions and margin lending transactions. Other off-balance-sheet items are adjusted by the relevant coefficient. For details, see BIS (2016a) or ESRB (2016a).

11 To better explain the role of the leverage ratio in capital regulation, we abstract from off-balance-sheet exposures and use a simplified leverage ratio defined as the ratio of Tier 1 capital to total assets. In other words, we assume that total assets equal total exposures.  

12 For details on the costs and benefits of introducing the leverage ratio, see Fender and Lewrick (2015).
The constraining effect of the capital and leverage ratios

The complementary relationship between the two tools suggests that they have different effects on a bank’s capital requirement (see Table 3). To illustrate those different effects, we chose the same settings of the two tools as in ESRB (2015), i.e. a total capital ratio expressed in terms of Tier 1 capital of 8.5% (a minimum requirement of 6% plus a 2.5% capital conservation buffer) and a microprudential leverage ratio of 3%. We then chose individual asset classes and corresponding regulatory risk weights based on the STA approach. The different effects of the leverage and capital ratios are clear from the last two columns of the table. A focus by banks on riskier assets is associated with a higher capital requirement based on the total capital ratio, whereas a focus on less risky assets is associated with a higher requirement based on the microprudential leverage ratio.

It can be seen in Table 3 that, given relevant settings of the two tools, the microprudential leverage ratio (3%) leads to the same capital requirement (CZK 3,000) as the total capital ratio (8.5%) at an average risk weight of 35%. With the said settings of the two tools, a risk weight of 35% therefore represents the critical average risk weight (CARW), which we obtain by dividing the total leverage ratio by the total capital ratio (3/8.5). The CARW is therefore the average risk weight at which the bank is equally constrained by the two capital regulation tools, or at which the bank must maintain the same capital requirement to comply with both tools.

\[ CARW = LR / RWR. \] (6)

It also holds that

\[ K^{LR} = K^{RWR}, \text{ if } CARW = RW, \] (7)

\[ K^{LR} > K^{RWR}, \text{ if } CARW > RW, \] (8)

\[ K^{LR} < K^{RWR}, \text{ if } CARW < RW. \] (9)

So, if both tools apply, the bank will be constrained by at least one of them at any given moment in time, depending on which capital requirement is higher: that based on the leverage ratio or that based on the capital ratio. The constraining effect of the specific capital regulation tool depends, in addition to its setting, on the bank’s business model or risk weight. Given the above settings of the two tools, if the bank has an average risk weight above 35%, it will be constrained by the capital ratio. Conversely, if the

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Table 3

<table>
<thead>
<tr>
<th>Asset class (100)</th>
<th>STA regulatory risk weights of banks (in %)</th>
<th>Capital Leverage ratio requirement</th>
<th>Risk-weighted requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central governments</td>
<td>0</td>
<td>3.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Financial institutions</td>
<td>20</td>
<td>3.0</td>
<td>1.7</td>
</tr>
<tr>
<td>Retail – mortgage loans</td>
<td>35</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Retail – consumer loans</td>
<td>75</td>
<td>3.0</td>
<td>6.4</td>
</tr>
<tr>
<td>Corporate sector</td>
<td>100</td>
<td>3.0</td>
<td>8.5</td>
</tr>
</tbody>
</table>

Source: Authors’ calculations

Note: As an example we chose an exposure of CZK 100,000 and assumed a microprudential leverage ratio of 3% and a minimum capital ratio of 8.5%. Using the formula for computing capital requirements, we calculated the capital requirements based on the leverage and capital ratios (last two columns, in CZK thousands).

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2.2 The constraining effect of the capital and leverage ratios

It can be seen in Table 3 that, given relevant settings of the two tools, the microprudential leverage ratio (3%) leads to the same capital requirement (CZK 3,000) as the total capital ratio (8.5%) at an average risk weight of 35%. With the said settings of the two tools, a risk weight of 35% therefore represents the critical average risk weight (CARW), which we obtain by dividing the total leverage ratio by the total capital ratio (3/8.5). The CARW is therefore the average risk weight at which the bank is equally constrained by the two capital regulation tools, or at which the bank must maintain the same capital requirement to comply with both tools.

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So, if both tools apply, the bank will be constrained by at least one of them at any given moment in time, depending on which capital requirement is higher: that based on the leverage ratio or that based on the capital ratio. The constraining effect of the specific capital regulation tool depends, in addition to its setting, on the bank’s business model or risk weight. Given the above settings of the two tools, if the bank has an average risk weight above 35%, it will be constrained by the capital ratio. Conversely, if the

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13 The leverage ratio is also expressed in terms of Tier 1 capital for now.

14 Although the capital conservation buffer is commonly classed as a macroprudential tool, it is in essence a newly defined element of the traditional microprudential capital requirements.

15 If we did not abstract from off-balance-sheet items for the leverage ratio, the equation would be: CARW = (LR/RWR) ∙ (TE/TA).
risk weight is below 35%, the leverage ratio will be constraining (see Chart 1). The CARW level therefore determines the constraining effect of the two tools.

If changes in the settings of the two tools are equal in percentage terms, the CARW level will not change (see Chart 1 and the CARW expressed as a line). If they change differently, the CARW will also change. An increase in the total capital ratio — for example in the form of the introduction of, or an increase in, macroprudential capital buffers — would lead to a decrease in the CARW and hence also in the constraining effect of the leverage ratio. There have therefore been proposals that the leverage ratio requirement should take into account the level of capital buffers and thus become a macroprudential policy tool.

3. THE MACROPRUDENTIAL LEVERAGE RATIO

Macroprudential capital buffers usually fulfil two macroprudential policy objectives: to prevent misaligned incentives for financial institutions (structural dimension of systemic risk) and to prevent excessive credit growth and leverage (cyclical dimension of systemic risk). In this section, we will look at possible ways of linking them to the macroprudential leverage ratio and its objective. We will therefore assume that the microprudential leverage ratio is in force as a capital regulation tool.

3.1 The structural and countercyclical macroprudential leverage ratios

To mitigate the structural dimension of systemic risk, CRD IV allows the application of a broadly defined systemic risk buffer (SRB). This buffer is currently usually applied to systemically important institutions and has the same objective as those for global and other systemically important institutions (G-SIls and O-SIls respectively). These buffers are meant to increase the resilience of systemically important institutions, whose failure could impair the stability of the entire financial system. ESRB (2015) describes the option of linking the above buffers to a “structural macroprudential leverage ratio”, the application of which would simultaneously increase the total leverage ratio.

In periods of excessive credit growth and leverage, which are associated with an elevated risk of future losses, CRD IV provides for the application of a countercyclical capital buffer17 (CCyB, for details see section 4.2.2 of this Report). The objective of the CCyB is to reduce the risk of excessive credit growth and the effect of the cycle on capital requirements. In booms, the risk weights of IRB banks18 can move procyclically (Aikman et al., 2014b) due to procyclicality in the components used to calculate them, as PD and LGD (see section 2 of this article) are derived from measures19 that tend to be lower in booms and higher in recessions. Given the recurring expansion and contraction phases of the economic and financial cycle, the economy can be expected to slow after a period of strong growth.20 The CCyB is therefore applied during a boom so it can later be released during a contraction. This should lead to greater resilience of banks and lower amplitude of the credit cycle. ESRB (2015) describes the option of linking the CCyB to a “countercyclical macroprudential leverage ratio”. Brei and Gambacorta (2014) find that the leverage ratio is a more countercyclical capital regulation tool than the capital ratio.

3.2 The setting of the macroprudential leverage ratio

The impact of (non-)introduction of the macroprudential leverage ratio

In section 2 we followed the lead of the ESRB (2015) by using a CARW of 35%. However, the CARW can vary depending on the settings of the total leverage and capital ratios (see Table 4). The CARW is lowered among other things by the introduction of macroprudential capital buffers without simultaneous introduction of a macroprudential leverage ratio. This lowers the risk weight indicating the minimum absolute capital requirement and reduces the constraining effect of the leverage ratio.

If, for example, the SRB is introduced for systemically important institutions and the structural macroprudential leverage ratio is not simultaneously activated, the CARW for those institutions will decrease, because the total capital ratio will rise while the total leverage ratio will remain unchanged. The CARW will thus be lower and the leverage ratio less constraining for systemically important institutions than for the rest of the sector. Conversely, if the structural

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17 The countercyclical capital buffer is governed by Article 136 of the CRD.
18 At the moment, procyclical movement in the components of risk weights can pose a risk to IRB banks. If risk triggers are introduced in the STA approach (BIS, 2015) a similar risk could apply to STA banks.
19 PD is derived from the ratio of NPLs to total loans in the investment portfolio and LGD from the rate of recovery of a given NPL.
20 In a contraction phase of the financial cycle, by contrast, PD, LGD and hence also risk weights tend to be overestimated even though they are often falling due to investments being moved into less risky assets. This could constrain lending activity and hinder economic recovery.
The macroprudential capital buffer is introduced simultaneously, the total leverage ratio will be higher and the maximum leverage level lower for systemically important institutions than for the rest of the sector.

If the countercyclical macroprudential leverage ratio is not activated at the same time as the CCyB, the constraining effect of the leverage ratio will decrease during an expansion phase of the financial cycle. The risk weight indicating the minimum absolute capital requirement will fall as the CARW decreases. Conversely, if the countercyclical macroprudential leverage ratio is simultaneously applied, the maximum leverage level will fall in an expansion phase of the financial cycle.

A rise in the macroprudential capital buffers without a corresponding increase in the macroprudential leverage ratio therefore always leads to a fall in the CARW and a decrease in the constraining effect of the leverage ratio. If, despite the fall in the CARW, the average risk weight remains lower than the CARW for some banks, an increase in the macroprudential capital buffers will not have a constraining effect on those banks. The capital requirement based on the macroprudential leverage ratio would remain higher than the capital requirement based on the total capital ratio (see section 2.2). These banks would thus continue to be constrained by the macroprudential leverage ratio, and their capital requirement would not take into account the increase in systemic risk. The introduction of the macroprudential leverage ratio could therefore have a positive effect on the attainment of macroprudential policy objectives, especially in a situation where systemic risk is rising and the risk weights of banks with significant market shares are below the CARW. This is because the macroprudential leverage ratio has a similar objective as the macroprudential capital buffers, the only difference being that it constrains banks with risk weights below the CARW, on which macroprudential capital buffers do not have a constraining effect.

According to ESRB (2015), for the purposes of setting the macroprudential leverage ratio it is possible to make some changes to it in line with the evolution of systemic risk or to apply a fixed rule that automatically keeps the CARW constant over time, which implies a constant constraining effect of the two capital regulation tools. In other words, they can use a fixed rule to ensure that the risk weight indicating the minimum capital requirement does not change. However, each of these options has its pros and cons. 21

We will not deal any further with minor adjustments to the macroprudential leverage ratio, as they can differ from case to case. We will concentrate on clarifying how the fixed rule is applied.

The setting of the macroprudential leverage ratio using the fixed rule with an initial CARW of 35%

We start with the example of setting the countercyclical macroprudential leverage ratio using a fixed rule keeping the CARW constant at 35%. Then we look at the effect of a different initial CARW on the macroprudential leverage ratio when the fixed rule is applied.

Charts 2a and 2b depict three different scenarios, all of them continuing to assume a macroprudential leverage ratio of 3% and a total capital ratio of 8.5%. In the initial scenario A, macroprudential buffers are not added to the total capital ratio and the CARW is therefore 35% (3/8.5). In scenarios B and C, the maximum CCyB of 2.5% is introduced. However, these scenarios differ in the introduction of the countercyclical macroprudential leverage ratio. In scenario B, the macroprudential leverage ratio is not introduced and the total leverage ratio remains at 3%. The CARW therefore falls to 27% (moving from point A to point B in Chart 2b). With this shift, the constraining effect of the capital ratio increases at the expense of that of the leverage ratio. In scenario C, the 2.5% CCyB is incorporated into the total leverage ratio so that the CARW stays constant at 35% (the fixed rule mentioned above). The total leverage ratio therefore rises to 3.9%, while the

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**Table 4**

<table>
<thead>
<tr>
<th>Items included in total capital</th>
<th>Total capital ratio (%)</th>
<th>Microprudential leverage ratio (%)</th>
<th>CARW (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1</td>
<td>6.0</td>
<td>3.0</td>
<td>50</td>
</tr>
<tr>
<td>Tier 1 + Tier 2</td>
<td>8.0</td>
<td>3.0</td>
<td>38</td>
</tr>
<tr>
<td>Tier 1 + CCoB</td>
<td>8.5</td>
<td>3.0</td>
<td>35</td>
</tr>
<tr>
<td>Tier 1 + Tier 2 + CCoB</td>
<td>11.5</td>
<td>3.0</td>
<td>26</td>
</tr>
<tr>
<td>Tier 1 + Tier 2 + CCoB + CCyB</td>
<td>14.0</td>
<td>3.0</td>
<td>21</td>
</tr>
<tr>
<td>Tier 1 + Tier 2 + CCoB + CCyB + SRB</td>
<td>17.0</td>
<td>3.0</td>
<td>18</td>
</tr>
</tbody>
</table>

**Source:** Compiled by authors

**Note:** Tier 1 = original capital, Tier 2 = supplementary capital, CCoB = capital conservation buffer, CCyB = countercyclical capital buffer, SRB = systemic risk buffer.

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21 For details, see ESRB (2015, pp. 29–30).

22 The situation is more complicated for the structural macroprudential leverage ratio, as it only applies to certain institutions.
countercyclical macroprudential leverage ratio is 0.9% (point C in Chart 2b). As the CARW is kept constant, the constraining effect of the two capital regulation tools remains the same as before the introduction of the CCyB. By definition, however, the minimum capital requirement increases and conversely the maximum possible leverage for banks decreases as the total leverage ratio rises.

The effect of the CARW level on the macroprudential leverage ratio when the fixed rule is applied
When the fixed rule is applied, the initial CARW level has an effect on the macroprudential leverage ratio in addition to the setting of the constraining effect of the two tools, as it holds that:

\[ \Delta LR = CARW \cdot \Delta RWR \]  

(10)

where \( \Delta LR \) is the change in the total leverage ratio and \( \Delta RWR \) is the change in the total capital ratio.

The initial CARW ranges between 26% and 50% (see Table 5), which, for example, given the introduction of the maximum CCyB and keeping the CARW constant, leads to a macroprudential leverage ratio in the range of 0.7%–1.3%.

**Table 5**

<table>
<thead>
<tr>
<th>Items included in total capital ratio</th>
<th>Total capital ratio</th>
<th>Microprudential leverage ratio</th>
<th>CARW</th>
<th>Makroobzřetelnostní pákový poměr</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CCyB = 2.5 %</td>
</tr>
<tr>
<td>Tier 1</td>
<td>6.0</td>
<td>3.0</td>
<td>50</td>
<td>1.3</td>
</tr>
<tr>
<td>Tier 1+Tier 2</td>
<td>8.0</td>
<td>3.0</td>
<td>38</td>
<td>0.9</td>
</tr>
<tr>
<td>Tier 1+CCoB</td>
<td>8.5</td>
<td>3.0</td>
<td>35</td>
<td>0.9</td>
</tr>
<tr>
<td>Tier 1+Tier 2+CCoB</td>
<td>11.5</td>
<td>3.0</td>
<td>26</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Source: Compiled by authors

Note: Tier 1 = original capital, Tier 2 = supplementary capital, CCoB = capital conservation buffer, CCyB = countercyclical capital buffer, SRB = systemic risk buffer. The macroprudential leverage ratio, given in the final three columns of the table, is computed as the CARW multiplied by the relevant macroprudential capital buffer.
4. EMPIRICAL ANALYSIS

In this section, we first analyse the relationship between the two capital tools and selected financial indicators for small and large banks in the Czech Republic in the period 2002–2015. These two bank types were chosen to illustrate the different relationships of these indicators for IRB and STA banks. Large banks started to migrate to the IRB approach to measuring credit risk in the second half of 2007 (shown by a vertical line in Charts 3a and 3b). Small banks still use the STA approach. Given the significant role of risk weights, we then use a simple vector autoregression (VAR) model to assess the different impacts of the level of, and changes to, risk weights on the leverage and capital ratios.

The data are not available in a long enough time series for us to compute the denominator of the leverage ratio. In what follows, therefore, we use a simplified leverage ratio calculated as the simple ratio of Tier 1 capital to total assets (instead of total exposures), i.e. excluding off-balance-sheet items. Czech banks are currently characterised by a relatively conservative business model focusing on lending to non-financial corporations and providing loans for house purchase. The Czech banking sector’s off-balance sheet is therefore relatively small, justifying the above simplification. Risk weights are calculated as the ratio of risk-weighted assets to total assets.

Charts 3a and 3b illustrate the evolution of the leverage and capital ratios, risk weights and ratio of loans to total assets on the example of small and large banks. Under both approaches, the risk weights are affected by the asset structure, which changes over time as a result of change not only in the ratio of loans to total assets, but also in the credit portfolio structure. However, the financial indicators used in the charts do not capture change in the credit portfolio structure. In the case of the IRB approach, the risk weights are also affected by the cyclicality of the components used to calculate them (especially PD; see sections 2.1 and 3.1 of this article).

It is apparent from Charts 3a and 3b that the risk weights for large banks started falling simultaneously with the switch to the IRB approach, while those for small banks started to go down six months later. In the case of small banks, this change and the subsequent decline can be
explained by a fall in the ratio of loans to total assets and a rise in the ratio of less risky mortgage loans to total loans. The ratio of loans for property purchase to total loans has increased by 34.1 pp in small banks and 9.7 pp in large banks since 2007. The ratio of loans to total assets in large banks has meanwhile tended to rise. The fall in risk weights in large banks cannot be explained solely by a change in asset structure, so migration to the IRB approach also played a role.

For a more detailed analysis, we employ an estimate of the integrated model of the dynamic conditional correlation, which allows us to analyse the relations between selected financial indicators and their time-varying nature (Engle, 2002). We view this approach as appropriate since it can be assumed that the tested correlations have changed as a result of structural changes (such as the financial crisis and changes to the regulatory methodology). The results show that there is a strong positive correlation between the ratio of loans to total assets and the risk weight for small banks (see Chart 4b). A moderately strong negative correlation is apparent between the capital ratio and the risk weights for both small and large banks. For both types of banks, the correlation between these two indicators is very different before and after the global financial crisis. The weakening of the correlation between risk weights and the capital ratio was due to the onset of the financial crisis combined with a change in the balance-sheet structures of individual bank types and regulatory changes. In large banks, it was also due to migration to the IRB approach, as evidenced by a weakening of the correlation between the two indicators starting in 2007. This did not happen in small banks until 2009. The correlation between risk weights and the leverage ratio is positive and much stronger again for small banks, although it weakened slightly at the end of the period under review.
THE ROLE OF THE LEVERAGE RATIO IN CAPITAL REGULATION OF THE BANKING SECTOR

4.1 The effect of the risk weight on the relationship between the capital and leverage ratios

In section 2.2 we stated that the CARW level determines the intensity of effect of the individual capital regulation tools in the banking sector. By comparing the CARW and the average risk weights we can determine which of the capital regulation tools has a constraining effect on a specific bank.

For the purposes of explaining the relationship between the leverage and capital ratios we have so far worked with a CARW of 35%, as in ESRB (2015). At this CARW level, the leverage ratio would represent a constraint for building societies in the Czech Republic, as for this type of bank the capital requirement based on the leverage ratio would be higher than that based on the capital ratio over the entire period under review (see Chart 5). However, a substantial decline in risk weights is visible for all the other types of banks in recent years as well.

Chart 6 depicts the risk weights and leverage ratios for specific banks. One bank would currently be non-compliant with a microprudential leverage ratio of 3%. If we were to take into account the setting of the macroprudential leverage ratio in the scenario highlighted in Table 5 (as also used by ESRB, 2015), i.e. a maximum countercyclical component of 0.9% and a structural component of 1.1%, another one bank would be non-compliant with the maximum total leverage ratio. For those two institutions and another two building societies, the leverage ratio would be constraining, as their risk weight is below 35%.

A simple VAR model is used to analyse the effect of a change in the risk weight on the leverage ratio and to compare it with the effect of a change in risk weights on the capital ratio. The relationship between the variables is illustrated using impulse response functions (IRFs), which express the response generated by an unexpected shock (impulse) to the current value and future values of the explained variables. We simulated the standard deviation response to a shock among the endogenous variables in the model in the 5% and 32% significance interval, a method described in more detail in Pesaran and Shin (1998). The analysis was conducted separately for each bank type using the leverage and capital ratios, risk weights and ratio of loans and receivables to total assets (endogenous variables) and the output gap of the euro area economy (exogenous control variable).

The leverage ratio rose and the capital ratio fell as the risk weights increased. Banks reacted to the growth in risks by topping up their capital, which led to an increase in the

25 No additional structural constraints were added to the models. All time series were seasonally adjusted. The VAR model does not display autocorrelation of residuals.

26 The output gap over the entire time series and the capital measures, which are available since 2014 at quarterly frequency only, were interpolated to monthly frequency using quadratic decomposition. Stationarity was ensured by converting the variables to year-on-year growth.
leverage ratio. However, the rise in capital was smaller than the rise in risk-weighted assets, so the capital ratio decreased. When the risk-weighted assets decreased, by contrast, the capital ratio rose and the leverage ratio fell. This shows that the two capital tools are complementary.

The response to a change in risk weights differed across bank types in the period under review (see Chart 7). The effect of a change in risk weights on the leverage ratio was particularly strong for small and medium-sized banks. It was insignificant for building societies, probably due to their specific business model and relatively stable risk weights.

By contrast, the effect of a change in risk weights on the capital ratio was particularly significant for building societies. This can be explained by their low risk weights, which imply a lower capital requirement, i.e. a lower numerator in the capital ratio. An increase in its denominator, or risk-weighted assets, then causes a larger decline in the capital ratio. Conversely, an increase in the total capital ratio, for example in the form of the introduction of a macroprudential capital buffer, will not necessarily increase the capital requirement significantly in a situation of low risk weights.

To sum up, the current decline in the risk weights of the individual bank types (see Chart 5) during the ongoing economic recovery is increasing the relevance of the introduction of the leverage ratio. A change in balance-sheet structure towards less risky assets is making banks more vulnerable to less probable losses.

5. CONCLUSION

This article provided evidence of a complementary relationship between the leverage and capital ratios. Using a simple vector autoregression model, this relationship was documented on Czech data by showing the different responses of the two tools to a change in the risk weight.

If the leverage ratio were to be incorporated into the legislation as a regulatory tool, it could be useful to introduce it as a supplementary capital regulation tool in the banking sector. The introduction of a microprudential leverage ratio increases banks’ resilience to less risky exposures. The setting of a macroprudential leverage ratio could also have a positive effect on macroprudential policy effectiveness in terms of mitigating cyclical and structural risks, especially if systemic risk arises at a time when risk weights are below the CARW for a large number of institutions with large market shares. To set the macroprudential leverage ratio, it may be appropriate to apply a fixed rule that keeps the CARW constant for all
bonds over time and hence also keeps the constraining effect of the two capital regulation tools stable and predictable. However, it is also possible to make one-off changes to its setting in line with the evolution of systemic risk, or to use a combination of the two.

Dynamic correlation results for the Czech Republic point to a weakening of the correlation between the capital ratio and risk weights, linked with a decline in risk weights for individual types of banks. In the case of large banks, the weakening of this correlation coincided with their migration to the IRB approach to measuring credit risk. In the case of small banks, it happened around two years later, when the global financial crisis broke out. This, coupled with a continued decline in risk weights and a change in the balance-sheet structures of individual types of Czech banks towards less risky assets is increasing the relevance of the microprudential leverage ratio and subsequently also the macroprudential leverage ratio as a supplementary capital regulation tool.

REFERENCES


