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Banks' capital accumulation does not hurt GDP growth

Bank capital ratios have risen

Following the financial crisis, Danish banks have increased their capital ratios.

Read more

GDP growth has not been adversely affected

There is no clear impact on GDP growth of banks' capital accumulation.

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Well-capitalized banks benefit the economy

There are clear economic advantages of a well-capitalized banking sector.

Read more

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FINANCIAL STABILITY

The years following the financial crisis saw a marked increase in the capital ratios of Danish banks. Danmarks Nationalbank's analysis shows no adverse effects on GDP growth if banks increase their capital ratios by raising new capital. Consequently, there are clear economic advantages of banks being sufficiently capitalised to absorb unexpected losses on their exposures.

Bank capital ratios

The average capital ratio of Danish banks has changed considerably over the last two decades. In 2000, the solvency ratio was 12.3 per cent, and in 2016 it had risen to more than 19 per cent, see Chart 1. The Tier 1 capital ratio shows a similar trend, as it rose from 9.6 per cent in 2000 to more than 17 per cent in 2016.

Capital ratios are a measure of banks' Tier 1 or total capital as a ratio of their total risk-weighted exposures. In simplified terms, the capital ratio can be written as:

$$Capital\ requirement = \frac{Capital}{Risk\ weights \cdot exposures}.$$

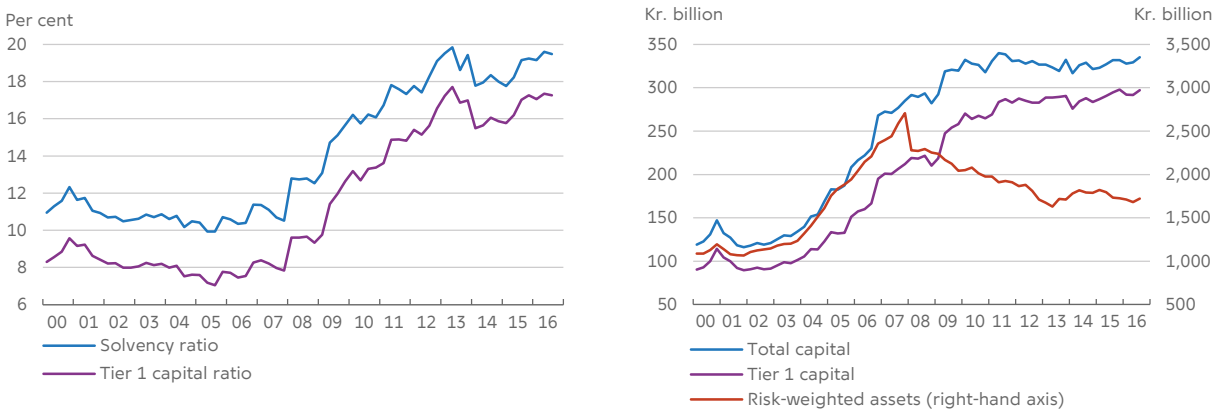
The capital ratio requirements for a bank are based on the principle that its capital adequacy must reflect the risks on its exposures to ensure that the bank is able to absorb unexpected losses. Each individual exposure is assigned a risk weight, summarising the risks and the expected loss on the exposure. Thus, higher-risk loans are assigned higher risk weights than less risky loans. Consequently, a bank's capital ratio can change for multiple reasons. For instance, the ratio may increase to reflect higher capital adequacy, but the ratio may also rise due to a change in exposures reflecting loans with lower risk weights, causing total risk-weighted exposures to fall. The risks on a single exposure may also decrease or increase.

Higher capital ratios following the crisis are driven primarily by falling risk-weighted assets

Average Tier 1 capital and solvency ratios increased substantially in the post-financial crisis years. In 2016, the average solvency ratio of Danish banks exceeded 19 per cent and the Tier 1 capital ratio exceeded 17 per cent. Higher capital ratios were due, in part, to higher Tier 1 and total capital, but the main reason was a decline in risk-weighted exposures.

The solvency ratio rose by more than 5 percentage points from 2007 to 2010, comprising two large increases. From the 4th quarter of 2007 to the 1st quarter of 2008, both the solvency ratio and the Tier

Bank capital ratios and capital base Chart 1



Note: Left: Weighted averages of Danish banks' capital ratios. Right: Banks' aggregate total capital and Tier 1 capital as well as risk-weighted assets (right-hand axis). Capital ratios comprise banks in the Danish Financial Supervisory Authority's groups 1-3. For all years, groups 1-3 comprise more than 96 per cent of the banking sector's balance sheet total
Source: Danish Financial Supervisory Authority and own calculations.

1 capital ratio increased by around 2 percentage points. The main driver of the increase was that the largest banks changed their method of calculating risk-weighted assets due to the implementation of the Basel II requirements. During 2008, several of the largest banks began to use Internal Ratings Based (IRB) approaches for the calculation of credit risk, subject to authorisation from the Danish Financial Supervisory Authority. Prior to 2008, risk-weighted assets were calculated using the standardised approach, based on fixed risk weights. Banks using IRB approaches must estimate one or more of the parameters underlying the risk approaches based on internal data. As the estimated parameters tend to be lower than the parameters of the standardised approach, the transition to IRB approaches led to an expected contraction in risk-weighted assets. Thus, risk-weighted assets decreased by approximately 20 per cent from the 4th quarter of 2007 to the 1st quarter of 2008.

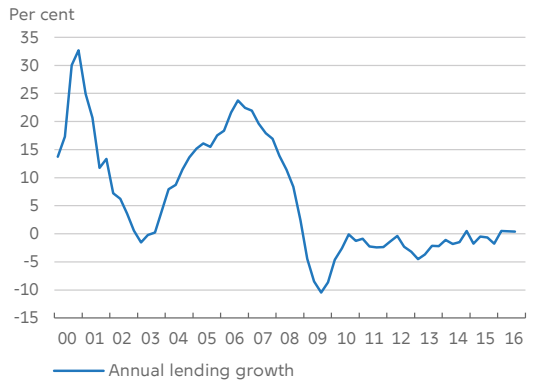
The second large increase in capital ratios occurred in the 1st half of 2009, with considerable rises in the banking sector's total capital and Tier 1 capital. A major driver was the injection of government Additional Tier 1 capital under Bank Rescue Package II. During the financial crisis, market expectations of banks' capital base increased in response to heightened financial market uncertainty. The aim of Bank Rescue Package II was to maintain banks' lending capacity and counter the risk of banks reducing their balance sheets and tightening credit standards.

The higher capital ratios should be seen in light of more stringent regulatory requirements for the capital base of individual banks in the post-crisis years, based on the recommendations of the Basel Committee. The new capital requirements will be phased in gradually from 2014 to 2019, by which time they must be fully complied with. In the 1st quarter of 2017, the systemically important financial institutions, SIFIs, complied with all fully phased-in 2019 requirements.

Bank capital ratios were falling in the run-up to the financial crisis

Throughout the 2000s, the banking sector gradually reduced its capital ratios. The solvency and Tier 1 capital ratios showed a decreasing trend from 2000 until the onset of the financial crisis in Denmark. In 2000, the banking sector's solvency ratio was 12.3 per cent, and by 2007 it had declined to 10.5 per cent. The Tier 1 capital ratio shows a similar trend, falling from 9.6 per cent to 7.8 per cent during the same period.

Lending growth Chart 2



Note: Annual bank lending growth to households and non-financial corporations.
Source: Danmarks Nationalbank.

This decline in the capital ratio is due to a proportionately higher increase in risk-weighted assets than in total capital and Tier 1 capital. Thus, from 2000 to 2007, risk-weighted assets increased by more than 125 per cent, while total capital and Tier 1 capital rose by 94 and 86 per cent, respectively. The same period saw a substantial increase in bank lending. Throughout most of the period, annual lending growth exceeded 10 per cent, cf. Chart 2. In other words, the banking sector increased its risk exposure without expanding its capital base correspondingly.

Economic impacts of capital increases

Well-capitalised banks offer clear economic advantages. Banks become more resilient to losses that could occur in a crisis. Danmarks Nationalbank has performed an analysis of the economic impacts of banks increasing their capital base. The analysis

examines the impact of banks' average solvency ratio on GDP growth through lending growth and the yield spread (the difference between banks' average lending rate and Danmarks Nationalbank's rate of interest on certificates of deposit (CD rate)). A structural VAR model is used in the analysis. See Box 1 for a detailed description of the model used.[1]

This approach requires that a number of assumptions are made about the directional impact of a higher solvency ratio on yield spread and lending growth. The impact on GDP growth is determined empirically in the model, and no directional assumptions are made about this impact.

To the extent that a higher average capital ratio leads to higher funding costs for banks, they may choose to pass on the costs to borrowers.[2] This will cause the yield spread to widen, potentially resulting in lower lending growth. Thus, the model assumes that the yield spread widens, while lending growth falls. The model calculates the extent to which the yield spread and lending growth are impacted by a higher solvency ratio. Thus, only the sign of the impact is determined by the assumptions.

Similar models have been used to analyse the impact of a higher capital ratio on other economies. Noss & Teffano (2016)[3] examine the impact of increasing the capital ratio on loans and GDP growth in the UK, and Kanngiesser et al. (2016)[4] have performed a similar analysis for the euro area. The findings of these analyses are comparable with Danmarks Nationalbank's results.

Capital accumulation does not impact GDP growth

Chart 3 summarises the results of the analysis. The analysis examines the impact of a 0.2 percentage

1 The analysis has also been performed using the Tier 1 capital ratio instead of the solvency ratio. Qualitatively, this analysis yields the same results.

2 Previously, Danmarks Nationalbank has analysed the costs of more equity. A higher proportion of equity leads to only a small increase in banks' overall funding costs. See *Financial stability*, 1st Half 2016, Danmarks Nationalbank.

3 Joseph Noss and Priscilla Toffano. "Estimating the impact of changes in aggregate bank capital requirements on lending and growth during an upswing." Journal of Banking & Finance 62 (2016): 15-27.

4 Derrick Kanngiesser, Reiner Martin, Laurent Maurin and Diego Moccero. "Estimating the Impact of Shocks to Bank Capital in the Euro Area." (2016).

Description of the model

Box 1

A structural vector autoregressive (VAR) model has been used to estimate the relationship between GDP growth and the banking sector's solvency ratio. VAR models are suitable for analysing dynamic relationships between two or more interdependent economic variables, since they allow feedback effects from one variable to others. The model includes Danish banks' solvency ratio, total capital, lending to the non-financial sector, credit yield spread as well as GDP growth and inflation. To enable the calculation of the effect of the build-up of banks' capital ratio, the *sign restrictions* approach is applied.[1] This approach requires that a number of assumptions are made about the directional response of the model's variables to an increase in banks' solvency ratio. It has been assumed that when the capital ratio increases in response to a rise in total capital, the yield spread widens and lending growth falls in a single quarter. The magnitude of these effects is determined empirically. No assumptions have been made about the sign of the impacts on GDP and inflation. The assumptions can be summarised as follows:

Assumptions about the impact of an increase in the solvency ratio

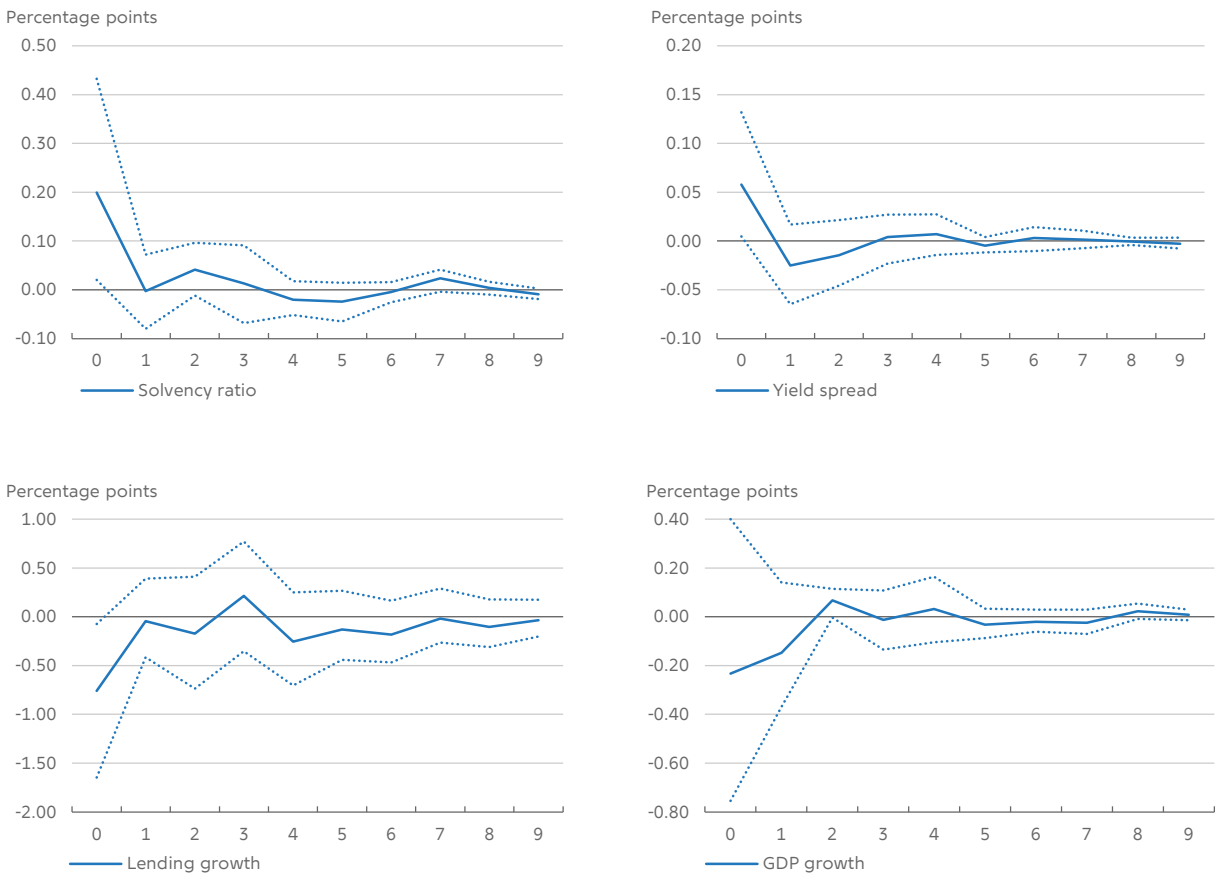
	Solvency ratio	Growth in total capital	Yield spread	Lending growth
Directional effect	+	+	+	-

Note: The signs indicate the response of the variables to an increase in the capital ratio. + indicates that the variable increases and – indicates that the variable decreases.

Using this approach, it is possible to calculate the impact on GDP growth of changes in the solvency ratio due to capital accumulation and not changes in risk-weighted assets. Thus, the results should be interpreted as *ceteris paribus* calculations.

1. See e.g. Harald Uhlig, "What are the effects of monetary policy on output? Results from an agnostic identification procedure", *Journal of Monetary Economics* 52 (2005), 381-419.

Estimated impact of a higher solvency ratio Chart 3



Note: The solid lines represent the estimated impact and the broken lines indicate uncertainty. The horizontal axis indicates the number of quarters after the change in the solvency ratio. The vertical axis indicates the change in percentage points for the quarterly lending and GDP growth as well as the change in the yield spread and the solvency ratio.
Source: Own calculations.

point increase in the banks' solvency ratio in a single quarter. This rise is the result of the raising of new capital – not of a change in risk-weighted assets.

The higher solvency ratio is reflected in a small increase in the yield spread, widening by just over 0.05 per cent in the quarter in which the solvency ratio increases. The yield spread subsequently narrows, thus having only a brief impact on lending rates. The short-term widening of the yield spread may reflect that part of the bank debt has yet to be refinanced. Therefore, the rate of interest on this part of the debt depends on the risk premium applicable before the proportion of equity rises. This could increase banks' funding costs for a brief period of time, until the debt has been refinanced.

Lending growth briefly falls by about 0.75 percentage point. However, this is a limited decline compared with the pre-financial crisis years when annual lending growth far exceeded 10 per cent.

There is no clear impact on GDP growth. The analysis results show a decrease in quarterly growth of approximately 0.2 percentage points, but the uncertainty of the results is too high to conclude

that the activity impact is negative. Accordingly, the brief decline in lending growth does not lead to any contraction in GDP growth.

In other words, the common denominator of the results is that the impact of accumulation of capital is limited. The yield spread and lending growth are impacted only briefly. No impact on GDP growth can be demonstrated, and the results do not indicate any activity implications from banks increasing their solvency ratios.

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