DANMARKS
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FINANCIAL STABILITY
1ST HALF

2016

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APPENDIX

FOREWORD

Under the 1936 Danmarks Nationalbank Act, Danmarks Nationalbank must maintain a safe and secure currency system and facilitate and regulate the traffic in money and the extension of credit. One of Danmarks Nationalbank's main objectives is thus to contribute to the stability of the financial system.

Danmarks Nationalbank defines financial stability as a condition whereby the overall financial system is robust enough for any problems within the sector not to spread and prevent the financial system from functioning as an efficient provider of capital and financial services.

In its *Financial stability* publication, Danmarks Nationalbank assesses financial stability in Denmark and presents its views and recommendations on measures that may contribute to enhancing financial stability. Furthermore, the publication is intended to stimulate debate about topics of relevance to financial stability and provide input for public authorities, individual financial institutions and financial sector organisations in relation to risk-assessment issues.

SUMMARY AND ASSESSMENT

EARNINGS SUPPORTED BY DECLINING LOAN IMPAIRMENT CHARGES

In 2015, the systemic credit institutions achieved the highest profit since the financial crisis. The rise in earnings was boosted by a strong decline in impairment charges on loans and guarantees relative to the preceding year.

The annual loan impairment charge ratio in 2015 was substantially lower than the average over the last three decades. The current low level of impairment is to some extent attributable to the fall in new loan impairment charges in recent years due to the improved economic situation. At the same time, some reversal of credit institutions' previous large loan impairment charges is taking place. Total loan impairment charges for the year are consequently reduced by major reversals of previous years' loan impairment charges. It will not be possible to continue this in future, when reversals are expected to be smaller, so loan impairment charges for the year are expected to be higher.

HIGHER NET FEE INCOME MAKES UP FOR LOWER NET INTEREST INCOME

Credit institutions' net interest income is under pressure from low demand for new loans and a low interest rate level with negative monetary policy interest rates. Market participants anticipate further monetary policy easing and expect interest rates to remain low for a prolonged period of time.

Conversely, fee income and administration margins account for increasing proportions of credit institutions' income and make up for the decline in net interest income. In the 1st half of 2015 in particular, developments in the financial markets contributed to high net fee income in the systemic credit institutions via a large volume of remortgaging and higher earnings from exchange rate hedging transactions. Income from fees declined in the 2nd half of the year, and the financial statements of the systemic institutions also show a fall relative to the 1st quarter of 2015.

Income from administration margins payable on mortgage loans has been going up, and the rise since 2010 primarily reflects higher administration margins. At the same time, administration margins have become more differentiated, as the margins for adjustable rate loans have increased more than for fixed rate mortgage loans. Increased differentiation ensures better coherence between price and risk on the various types of mortgage loans.

INSTITUTIONS MUST ADJUST TO A SITUATION OF LOW DEMAND FOR NEW LOANS

Demand for new loans remains limited. The continued high debt levels and high savings of households and firms may contribute to the future demand for loans remaining low. This is reflected in Danmarks Nationalbank's lending survey, in which the institutions' credit managers assess that demand for new loans is limited.

If lending growth remains limited, this may create a need for further adjustment of credit institutions' capacity with the focus on reducing costs and increasing efficiency.

CREDIT RATING OF HOME BUYERS SHOULD ALLOW FOR THE RISK OF SUDDEN HIKES IN INTEREST RATES AND DROPS IN HOUSE PRICES

The costs of borrowing to purchase a home have been very low in recent years. The current combination of economic growth, low demand for new loans and rising house prices may cause credit institutions to ease their own credit rating requirements. It is important for the institutions to allow for a sudden rise in interest rates and a fall in asset prices, including house prices, in their credit ratings of customers. Increased resilience to higher interest rates and falling house prices can be achieved e.g. by choosing longer fixed interest periods or lower debt levels relative to home buyers' income and wealth.

CREDIT INSTITUTIONS HAVE HIGH RETURN ON EQUITY TARGETS

A number of institutions target an annual return of up to 12.5 per cent after tax on their book value of equity. Given the very low level of interest rates, the return on equity, ROE, targets set by these institutions appear high. One way for the institutions to achieve a high ROE is to increase their risk. This can be done via more risky lending or by reducing equity relative to exposures.

Credit institutions' targeted returns exceed the return on book value of equity currently required for shareholders to be ready to invest in bank shares. This is attributable to the low risk-free interest rate as well as lower risk premia to buy Danish bank shares. Lower risk premia should be viewed in the light of factors such as the institutions' increased capitalisation and collateral requirements in recent years, as well as their improved liquidity reserves.

Credit institutions should carefully consider whether their current targeted returns are fully consistent with a prudent level of risk.

SYSTEMIC CREDIT INSTITUTIONS COMPLY WITH CAPITAL REQUIREMENTS ALREADY ADOPTED

All systemic credit institutions have solid excess capital adequacy relative to the current requirements. This helps to ensure that they have sufficient capital for absorbing any future losses that will not be covered by current earnings.

The capital requirements for credit institutions will be gradually tightened towards 2019, when the EU will phase in a number of capital requirements already adopted. All systemic credit institutions complied with these requirements at the end of 2015. The enhanced requirements comprise the phasing-in of a capital conservation buffer for all credit institutions and a SIFI capital buffer for systemically important financial institutions, SIFIs, the size of which depends on the group's systemic importance. In addition, a countercyclical buffer was introduced, but it is currently set at 0 per cent.

Results from Danmarks Nationalbank's accounting-based stress test, which assesses the excess capital adequacy of banks over the next three years through various macroeconomic scenarios, show that all the systemic banks will maintain substantial excess capital adequacy in 2018 relative to the minimum requirements in a severe recession scenario. In the severe recession scenario, some systemic financial institutions will have a small capital shortfall in 2018 relative to the total capital requirement, including buffers. In the event of non-compliance with the buffer requirements, the Danish Financial Supervisory Authority has imposed a number of limitations on the institution's activities, e.g. limitations of dividend payments. Moreover, the institution should expect that its access to external funding in the financial markets may be challenged if the buffer requirements are not met.

The equity market's forward-looking assessment of credit institutions can be used to get an indication of the market's view of the institutions' resilience under stress. Hence, the equity market's assessment may supplement Danmarks Nationalbank's accounting-based stress test. For that purpose, Danmarks Nationalbank uses the systemic risk measure SRISK. According to SRISK, the listed systemic credit institutions currently have positive excess capital adequacy in a severe stress situation, but the excess capital adequacy has been declining in 2016. The most recent fall in the excess capital adequacy was driven mainly by falling equity prices and a drop in the market value of the institutions' assets under stress. This may reflect investors' concerns that banks' earnings potential will weaken in the future.

CREDIT INSTITUTIONS HAVE ROBUST LIQUIDITY RESERVES

The liquidity coverage ratio, LCR, of all credit institutions is comfortably above the statutory

minimum requirements. The systemic credit institutions must comply with an LCR of minimum 100 per cent, while the non-systemic credit institutions must comply with an LCR of 70 per cent in 2016.

The LCR requirement must be complied with for all currencies together. It is important, however, that the institutions' foreign exchange liquidity risk management is adequate and that they have a sufficiently robust business model to counter a stress scenario of foreign exchange liquidity outflow. Consequently, it is important that the credit institutions' business models are not based on access to foreign exchange from the central banks.

The financial crisis showed that moving from one currency to another in the market can be difficult. Accordingly, credit institutions should build up a portfolio of high-quality liquid foreign exchange assets to ensure that they have access to liquidity in the significant currencies in which they have outflow of liquidity. A portfolio of high-quality liquid foreign exchange assets to counter a stress scenario of liquidity outflow in the currency concerned will support financial stability and reduce the likelihood that the central banks must provide emergency liquidity in foreign exchange as seen during the financial crisis.

NEW REGULATION PROPOSALS MAY SUBSTANTIALLY INCREASE RISK-WEIGHTED CREDIT EXPOSURES

With a view to strengthening the framework for risk-weighted capital requirements, the Basel Committee has presented various proposals to address model risk and measurement errors in internal model approaches, among other issues. These measures comprise proposals for a leverage ratio, a capital floor and floors for the model parameters used in the calculation of risk weights in internal model approaches.

It is in the interest of Denmark to have a level playing field for credit institutions across national borders. Common requirements, standards and practices across countries provide a basis for enhanced financial services competition for the benefit of customers. Uniform rules also benefit Danish credit institutions, as they can operate on the same terms across national borders. Moreover, for confidence in Danish credit institutions, it is essential that they meet international investors' standards and expectations.

The Basel Committee's proposals imply that a common bottom limit may be imposed on all credit institutions, e.g. a floor for risk-weighted exposures. But setting a common limit is difficult, as the risk of the institutions' credit exposures varies widely. This may be attributable to different business models, but also to differences in structural factors across countries. For example, under Danish legislation, creditors are in a relatively good position in the event of default on loans secured on real estate. This reduces credit institutions' risks and losses, which contributes to the very low Danish risk weights for such loans.

The Basel Committee's proposed measures may give credit institutions inexpedient incentives, because they may enable the institutions to increase their risk without increasing their capitalisation, if the measures are binding. Consequently, it is important that the Basel Committee's proposed measures do not prevent the internal model approaches from working in cases where the estimated risk weights correctly reflect very low risks. The proposed measures should act *only* as backstops, meaning that the requirements should be binding only in cases where the risk weights have become *too* low.

Crude calculations indicate that the Basel Committee's proposal for a capital floor, which was published at the end of 2014, will increase risk-weighted exposures noticeably in the largest credit institutions in Denmark. It is essential that the final design of the capital floor is sufficiently differentiated in order to allow for fundamental factors related to credit risk, e.g. differences in the rules on liability and default in the individual countries.

CYBERATTACKS ARE A POTENTIAL THREAT TO FINANCIAL STABILITY

The financial sector's dependence on complex IT systems requires a lot from sector participants in terms of management of operational risk, including external threats such as cyber risk. An extensive cyberattack could potentially disrupt all or significant parts of the sector for a period. Hence, the risk of cyberattacks in the financial system is of a systemic nature – i.e. it is a potential threat to financial stability.

The interconnectedness of the financial sector means that participants have a shared responsibility for handling mutual risk in a safe and

efficient manner. For this reason, a sector forum has been set up to create an overall framework for knowledge-sharing and collaboration across the sector.

2

DEVELOPMENT AND TRENDS

MACROECONOMIC AND FINANCIAL BACKGROUND

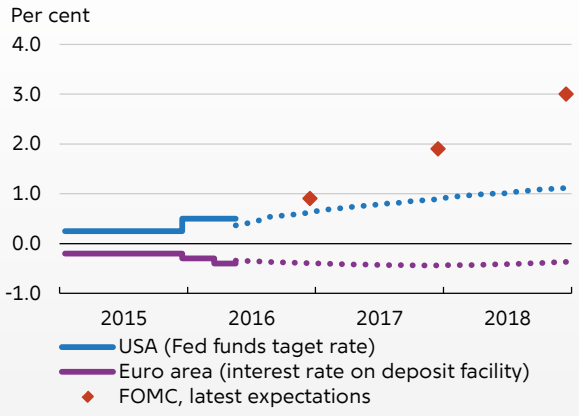
INTEREST RATES REMAIN VERY LOW AND THE GROWTH OUTLOOK IS INCREASINGLY UNCERTAIN

The level of interest rates in the euro area has declined this year. In March, the European Central Bank, ECB, reduced its monetary policy interest rates, including the deposit rate, which was reduced by 10 basis points to -0.4 per cent, cf. chart 2.1. The reduction was designed to lower the risk that the low level of inflation has a spillover effect on wage formation and in order faster to reach the ECB's inflation target of below, but close to, 2 per cent. Inflation in the euro area is low, which is partly attributable to developments in oil prices. Market participants anticipate further monetary policy easing and expect interest rates to remain low for a prolonged period of time.

Simultaneously with the interest rate reduction, the ECB increased its monthly purchases of, inter alia, government bonds and expanded the programme to include corporate bonds. In addition, four new targeted longer-term refinancing operations, TLTROs, were launched, each with a maturity of four years. The objective of the TLTROs is to give credit institutions in the euro area access to cheap funding of loans to households and corporate customers. If the institutions comply with certain requirements in terms of lending developments, the TLTRO interest rate could fall to the same negative level as the current ECB deposit rate.

Since 2014, several other central banks have also lowered their monetary policy interest rates into negative territory, and negative market rates on government bonds are now common internationally. However, in the USA, short-term interest rates are trending upwards. In December, the Federal Reserve raised their interest rate a little for the first time in more than nine years. Members of the Federal Open Market Committee, FOMC, are currently expecting the interest rate to be raised by a total of 0.5 percentage points this year and 1 percentage point in 2017. That is a somewhat higher interest rate increase in 2017 and 2018 than what is currently factored into market prices.

Monetary policy interest rates and market expectations Chart 2.1



Note: The Fed funds target rate shows the upper limit of the target range, which is currently 0.25-0.5 per cent. The FOMC's expectations are from March 2016, showing the median of the FOMC members' expectations of the centre of the target range. The broken lines indicate the market expectations of 27 May 2016. For the USA, these expectations are calculated based on Federal funds futures. For the euro area, expectations are calculated based on the Overnight interest swap rates.

Source: FOMC, Macrobond and Scanrate Rio.

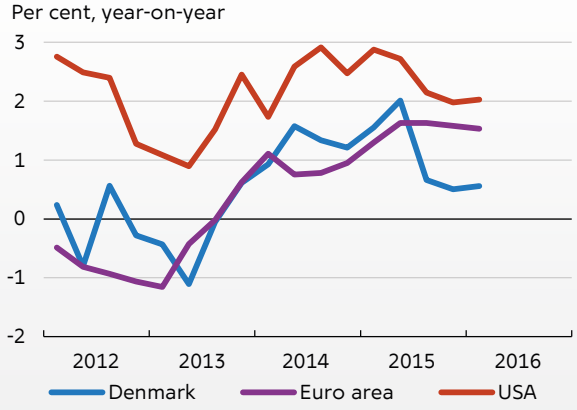
On 23 June, the UK will vote on whether to remain in the EU. In the first part of the year, concern over a possible Brexit has been affecting the financial markets, weakening the pound sterling. At its Monetary Policy Committee meeting in April, the Bank of England assessed that uncertainty about the outcome of the referendum has slowed growth this year. If the referendum in the UK were to produce a vote in favour of leaving the EU, an extended period of political uncertainty over the UK's new relationship with the EU would follow, which could have a spillover effect on the financial markets. Danish financial institutions have relatively limited direct exposures to the UK. London's financial sector is crucial to the financial markets across Europe, and thus Danish credit institutions could be indirectly exposed to increased volatility.

Slightly lower global economic growth

Among the advanced economies, US growth has slowed down in recent quarters, albeit from a high level, cf. chart 2.2. In the euro area, GDP growth rates are slightly lower, but stable. Measured per capita, growth is roughly at the same level in the US and in the euro area.

A number of the emerging market economies are negatively affected by the very low oil prices and the declining rate of growth in China. Looking ahead, international organisations are expecting global economic growth to be slightly higher, but the risk that it will be more subdued has increased.

Growth in real GDP Chart 2.2



Note: The most recent observations are from the 1st quarter of 2016.
Source: Macrobond and OECD.

In Denmark, growth in employment continued in the first part of 2016 and increased by 11,000 persons in the first quarter. In Danmarks Nationalbank's projection, growth is expected to increase in the coming years and spare capacity in the economy will become scarcer. The uncertainty of the projection is linked to the strength of employment growth and growth rates abroad, including in China.

VOLATILITY IN EQUITY MARKETS INCREASED THE LEVEL OF FINANCIAL STRESS

Investor perception of risk changed at the beginning of the year, leading to substantial downward adjustment of asset prices in some financial markets. Since then, markets have settled down, but this incident exemplifies how volatility can increase suddenly and quickly.

According to Danmarks Nationalbank's composite financial stress indicator, global financial volatility led to a higher level of stress in the Danish financial system, cf. chart 2.3 (left). Global equity prices declined, driven, among other factors, by investor concerns about the growth outlook for China and generally higher uncertainty over global growth. The level of stress in euro area financial markets also increased at the beginning of the year.[1] Nevertheless, in a long-term perspective, the level of stress measured in Denmark is low.

Banks are exposed to general economic developments, and bank equities generally dropped more sharply than other equities. Investors are concerned, inter alia, that the exceptionally low interest rate environment could squeeze banks' future earnings potential. In Denmark, the development in the equity prices of listed systemic credit institutions has been weaker than that of the composite C20 index since mid-2015, cf. chart 2.4 (left)

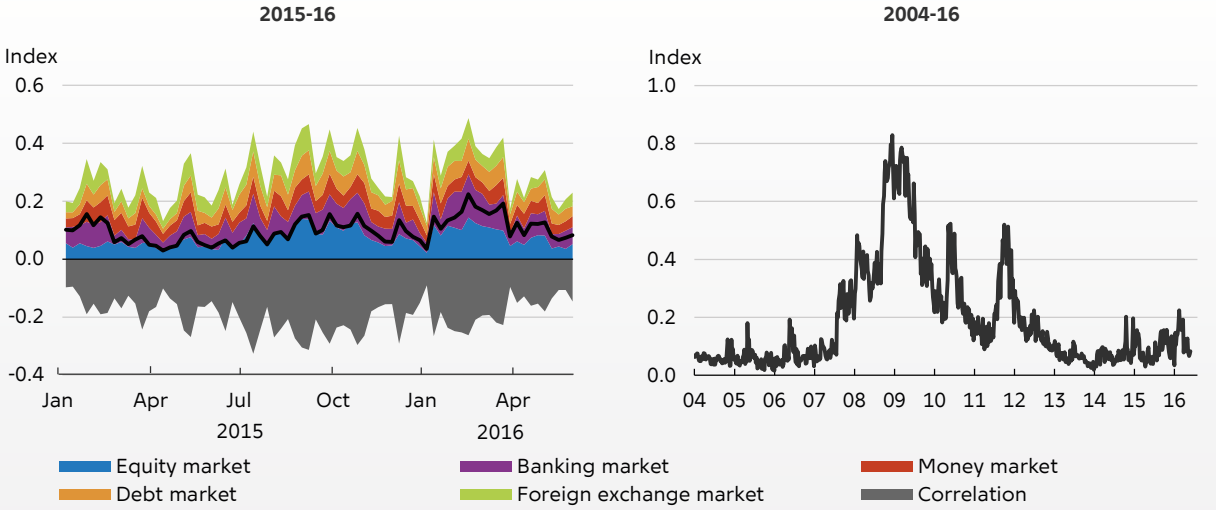
Prices of the institutions' issuances of subordinated debt fell in February, but later recovered. The price fluctuations reflected developments in equity prices. These debt instruments are convertible, i.e. they can be converted to equity if the capital ratio of an institution declines below a pre-determined level. Moreover, regular payments to investors may, in some cases, be suspended.

Danmarks Nationalbank's composite financial stress indicator measures the current stress level

1 ECB's Composite Indicator of Systemic Stress, CISS, see European Systemic Risk Board, *ESRB Risk Dashboard*, March 2016.

Financial stress indicator for Denmark

Chart 2.3

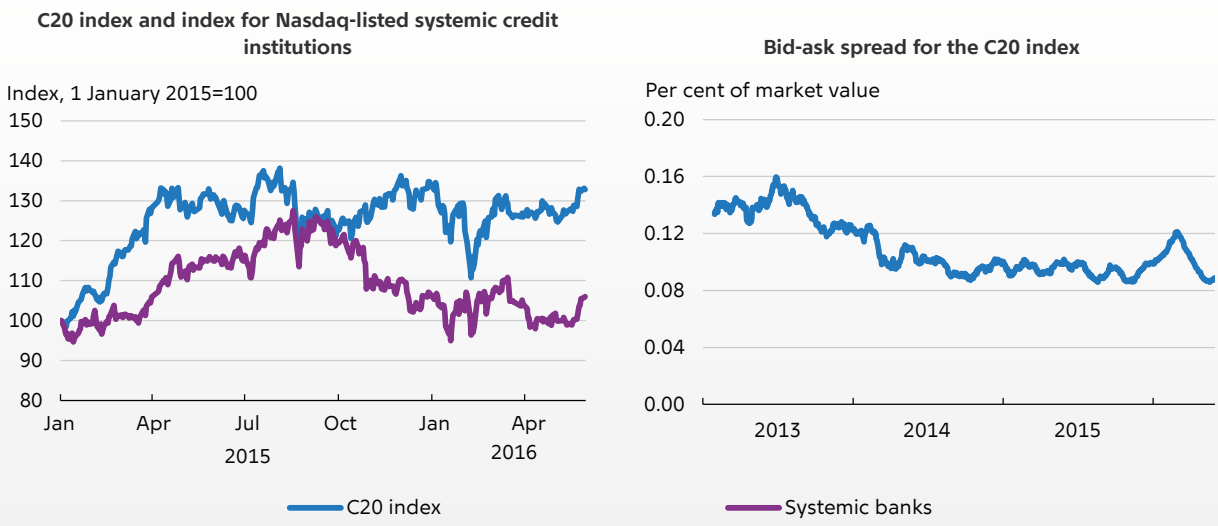


Note: The left-hand chart shows the stress indicator from January 2015 onwards and the contribution from the indicator's five submarkets and the correlation between the markets. The stress indicator has been constructed to include deductions for low correlation between the various markets and thus a lower stress level. The value of the composite indicator is between 0 and 1, a value of 0 indicating very low volatility, while the opposite is true of a value of 1. The right-hand chart shows the stress indicator for a longer period from January 2004 onwards. The most recent observations are from 29 May 2016. The components and calculations of the stress indicator are discussed in Appendix 2 in Danmarks Nationalbank, *Financial stability*, 2nd Half 2014.

Source: Bloomberg, Nordea Analytics and own calculations.

Equity prices and volatility in the Danish equity market

Chart 2.4



Note: The left-hand chart shows daily observations of the C20 index with the 20 currently most traded Danish equities and a weighted index for systemic groups listed on Nasdaq Copenhagen, i.e. Danske Bank, Jyske Bank and Sydbank. The right-hand chart shows a 20-day simple average of the bid-ask spread for the equities in the current C20 index. The bid-ask spread is shown as a percentage of the market value at which investors are willing to sell the equity (the ask price). The most recent observations in the charts are from 31 May 2016.

Source: Bloomberg and Nasdaq OMX Copenhagen.

and cannot be used for measuring the build-up of systemic risk. This is supported e.g. by the situation prior to the financial crisis, which was characterised by a low measured stress level, while systemic risks were building up in Denmark and globally, cf. chart 2.3 (right).

Higher volatility in the Danish equity market contributed to the increase in the measured stress level at the beginning of the year. The index of the 20 most traded Danish equities, the C20 index, plunged in January 2016 but subsequently recovered, cf. chart 2.4 (left).

Equity market volatility may reflect a period of frequent changes in investor expectations, but may also be due to lower market liquidity. Financial market illiquidity may be assessed by the bid-ask spread, i.e. the difference between the prices at which investors buy and sell. The average bid-ask spread for equities in the C20 index widened during the most recent period of market volatility, but has subsequently fallen back to its former level, cf. chart 2.4 (right).

LOW INTEREST RATES LEAD TO RISK OF BUILD-UP OF SYSTEMIC RISKS

The very low interest rate environment and expectations of continued low interest rates in the coming years increase the risk of a build-up of systemic risks in the financial system. The level of interest rates may whet the risk appetite of financial market actors in their search for returns, for instance prices in the global equity markets have been rising for several years.

The Systemic Risk Council finds that due caution should still be exerted in relation to build-up of systemic risks, given the very low level of interest rates.[2] The Council points out that a sudden change in the perception of risk in the financial markets combined with low market liquidity may lead to substantial falls in asset prices and fire sales. Market participants may underestimate the implications of a sudden reversal of the risk perception, meaning that they fail to build sufficient resilience.

An unexpected and sudden increase in the level of interest rates could lead to strong adjustments and high volatility in the financial markets. International organisations' growth and inflation forecasts indicate that, in the longer term, monetary policy interest rates should rise to levels well above the current ones.[3] The transition towards that level may not be steady and smooth. In a scenario in which financial markets have doubts about the future monetary policy stance and investors are very active selling bonds, interest rates may rise sharply and quickly. A sudden yield increase for 10-year government bonds will lead to considerably lower prices of these bonds, which may negatively affect highly leveraged market participants who regularly have to post margin requirements.

In Denmark, a large share of long-term government and mortgage bonds are held by Danish pension and insurance companies with business models that are to a large extent resilient to interest rate fluctuations. In a situation with rising interest rates, the Danish credit institutions will, in the short run, suffer losses on their holdings of long-term bonds. However, contrary to Danish pension and insurance companies, credit institutions primarily invest in short-term bonds that are less sensitive to interest rate changes. In the slightly longer term, higher interest rates can negatively impact house prices and increase borrowing costs for households and the corporate sector, which in turn may weaken macroeconomic stability.

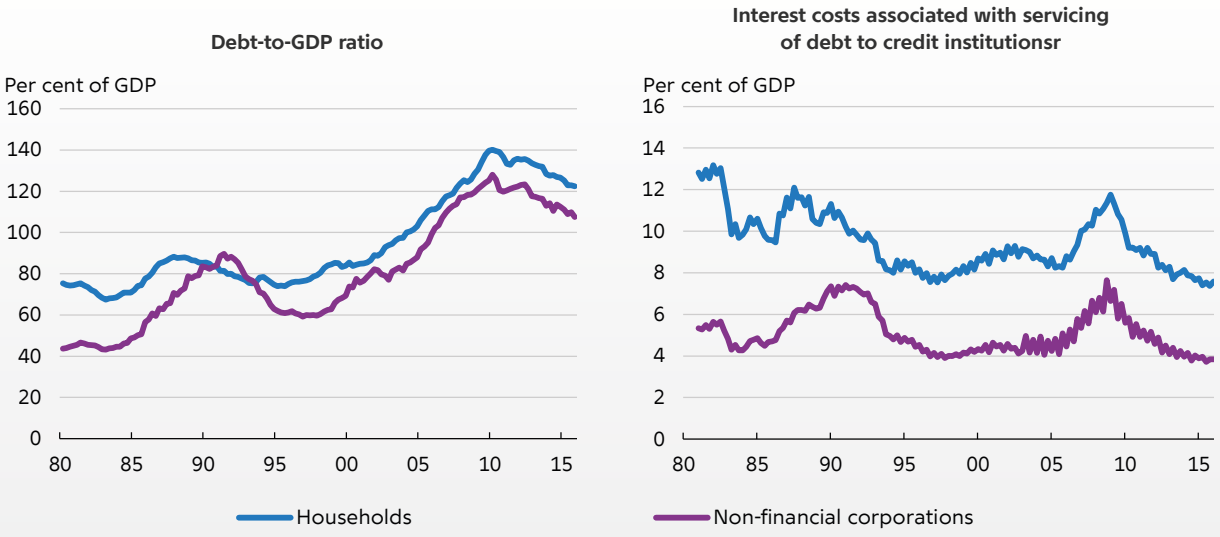
IN DENMARK, THE HIGH LEVEL OF DEBT IS SLOWLY COMING DOWN

The debt-to-GDP ratios, i.e. debt ratios, of Danish households and firms have been declining since 2010, cf. chart 2.5 (left). This trend seems to have continued at the beginning of this year. It remains to be seen how quickly and to what extent debt ratios will decrease in future. Households and firms are still highly leveraged, but the fall in interest rates since 2008 has reduced their debt service costs, cf. chart 2.5 (right). On the one hand, lower debt service costs increase the possibility of reducing debt, but, on the other, lower costs may increase the incentive to raise further debt or omit to reduce existing debt.

2 In September 2014, the Systemic Risk Council announced an observation concerning low interest rates and the build-up of systemic risks, and at its latest meeting in March 2016 the Council pointed out that this observation was still relevant.

3 See Abildgren, Kim, Anders Kronborg and Oliver Juhler Grinderslev, Scenarios for normalisation of the level of interest rates, Danmarks Nationalbank, *Monetary Review*, 2nd Quarter 2016.

Households and firms' leverage and debt service ratio Chart 2.5



Note: In the left-hand chart, debt is all loans and securities issued excluding equities. Debt service costs are calculated as interest payments and administration margin payments to banks and mortgage banks. The most recent observations in the left-hand chart are 4th quarter of 2015 and in the right-hand chart March 2016.
Source: Danmarks Nationalbank, Statistics Denmark and own calculations.

Danish households and firms increased their debt in the run-up to the financial crisis when the economy was overheated and the credit conditions of some credit institutions were too loose. Some of the debt was secured by real estate as collateral, sending real estate prices soaring. When house prices subsequently fell without a corresponding reduction in debt, net wealth, i.e. the difference between gross wealth and gross debt, came under pressure. Subsequently, higher real estate prices since 2012, in concert with appreciation of financial assets such as equities, have contributed to an increase in household net wealth.

Danish economic growth since 2013 has, inter alia, reflected higher corporate earnings and household incomes. However, neither households nor firms have begun to reduce their debt levels, and their debt ratios have declined only as a result of GDP growth. Danish households have raised virtually no additional debt after the financial crisis, while firms have reduced their debt slightly. Instead, both sectors have increased savings and consolidated assets.

The low demand for new loans may reduce credit institutions' opportunities for increasing earnings through higher lending activity.

Danish households have both high debt and high wealth, entailing that their debt ratio is among the highest in the world, while their net wealth is on a par with comparable countries. In Denmark, raising loans against assets as collateral is relatively cheap and easy, for instance a large segment of Danish home buyers have raised loans secured on their homes. At the same time, households have accumulated sizeable pension wealth invested through pension companies. This way, the financial sector enables households to have large debt, while at the same time holding on to large assets, and the sector's earnings are based partly on this.

Households' balance sheet structures reflect the institutional framework, including the tax regime under which the interest deductibility on debt increases the incentive to raise large debt, while the tax deductibility of pension contributions increases the incentive to accumulate wealth. The structure of the pension system, including labour market pensions, also helps to increase household savings. Box 2.1 describes the findings of an analysis of the 2010 tax reform, which demonstrates a link between debt accumulation and pension savings for individuals affected by the reform.

Impact on household debt of tax deductibility for pension contributions

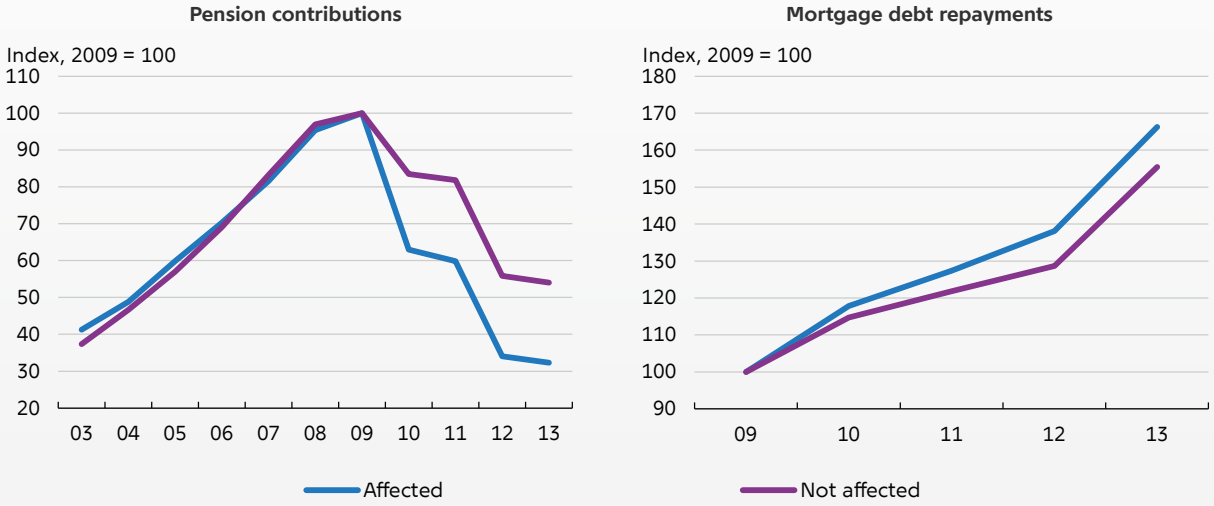
Box 2.1

The link between household pension savings and gross debt is examined in an analysis by Andersen (2015)1. The 2010 tax reform, which reduced the tax incentives for saving in parts of the pension system, is used.

The findings of the analysis show that Danes who were likely to be affected by the changed rules in the year of reform substantially reduced their pension contributions as a result of the change in tax rules, cf. Chart A (left). However, the reduction in pension contributions was offset by higher repayments on household debt, including repayments on mortgage debt, cf. Chart A (right).

The mortgage debt repayments of the individuals affected increased by an average of up to kr. 0.19 for each krone reduction in private pension contributions. Moreover, individuals with high LTV ratios or high debt were also more likely to make repayments on their debt when the tax incentive for saving in pension accounts was reduced.

Chart A. Reform impact on pension savings and mortgage debt



Note: The charts show the development in average pension contributions and nominal mortgage debt repayments for each year for affected and non-affected individuals. Affected individuals include individuals whose incentive to save in annuity pension schemes would likely be reduced as a result of the tax reform. Conversely, the savings behaviour of non-affected individuals would likely remain unchanged. The reform introduced a tax deduction threshold of kr. 100,000 on annual contributions for annuity pension schemes. The individuals affected contributed more than this amount prior to the announcement of the reform, while those not affected paid lower contributions.

Source: Andersen, Henrik Yde (2015), Do tax incentives for saving in pension accounts cause debt accumulation? Evidence from Danish register data, Danmarks Nationalbank, *Working paper* No. 101.

Previous analyses have not been able to demonstrate a causal link between pension savings and mortgage debt. The new analysis uses Danish register data to follow the changes in household savings around the time of the tax reform. This way, it is possible to identify and measure the impact of the tax reform on individual savings decisions.

The tax reform affected individuals with incomes above the national average, who contributed to privately managed pension schemes prior to the reform. Thus, the findings relate to this group only. If the findings hold true for the broader Danish population, the pension rules could have a noticeable impact on the accumulation of household debt.

1. Andersen, Henrik Yde (2015), Do tax incentives for saving in pension accounts cause debt accumulation? Evidence from Danish Register Data, Danmarks Nationalbank, *Working paper* no.101.

RISKS OF CREDIT INSTITUTION LOANS SECURED ON REAL ESTATE

CREDIT INSTITUTIONS HAVE GRANTED LARGE LOANS TO THE COMMERCIAL PROPERTY SECTOR

Danish credit institutions have granted large commercial property loans and a substantial portion of these loans have been granted to thinly capitalised commercial property companies. This, in combination with volatile prices of commercial properties, means that granting loans to this sector may involve a high degree of risk.

Commercial property loans is a significant business area for Danish credit institutions, with mortgage bank loans totalling kr. 641 billion secured on commercial properties and bank loans to the property sector totalling kr. 110 billion, equivalent to 19 per cent and 5 per cent, respectively, of the institutions' total loans at end-2015. Banks are substantially more exposed to the commercial property market than these figures suggest, given that commercial properties in all industries are often pledged as collateral for loans. At the same time, the risk of losses for banks is considerably higher than for mortgage banks, as mortgage bank loans may not exceed 60 per cent of the value of commercial properties, while banks can accept the remaining property value as collateral. In case of the borrower's default, the value of the estate initially covers repayments to the mortgage bank, and subsequently to the bank.

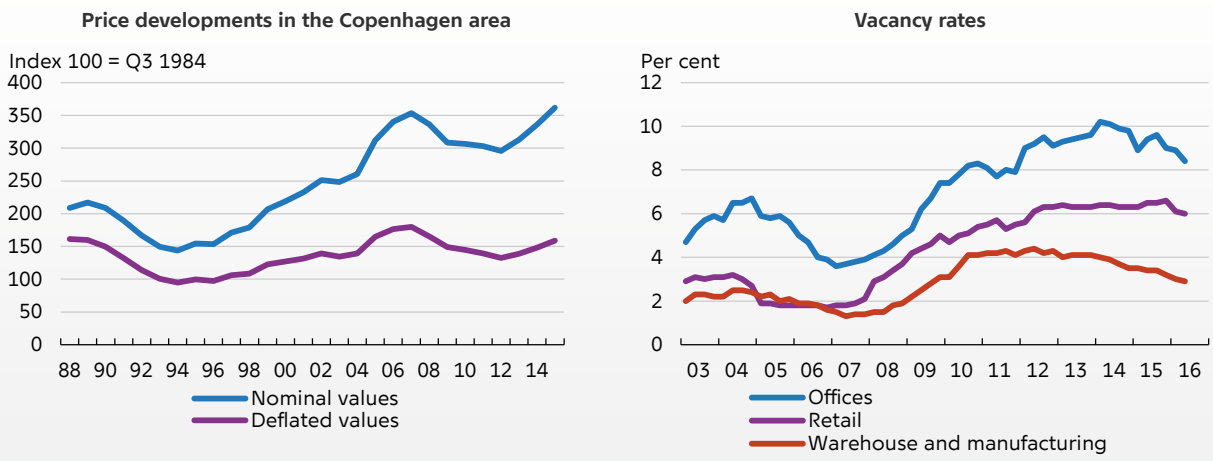
The commercial property market differs from the housing market in several respects and caused banks to incur major losses during the financial crisis. Valuation of commercial properties is difficult. The commercial property market is very heterogeneous and properties are often built for a particular user whose requirements do not necessarily match those of other potential owners. If the user of the property is declared bankrupt, the construction costs may be substantially higher than the market value. Moreover, personal liability does not apply (as is the case for loans to private individuals). If the borrower is declared bankrupt, the creditor must shoulder the loss.

Commercial property prices are volatile

As many commercial properties are not owned by their users but by investors, the group of owners plays an important role in the price dynamics of the commercial property market. If investors have a short time horizon or are thinly capitalised, this could amplify price fluctuations in the market.

Commercial property prices in the Copenhagen area have now returned to pre-financial crisis levels, cf. chart 2.6 (left). During the financial crisis, the average value of commercial properties plunged by close to 20 per cent and a number

Price developments in the Copenhagen area and vacancy rates for commercial properties Chart 2.6



Note: The price index is based on sales and assessments made by Sadolin & Albæk. Adjustment is made for the various property characteristics, including location, use, state of repair, etc. The most recent observations are for 2015. The vacancy rate is the percentage of all available units in the property category in question that are vacant. The most recent observations are for the 2nd quarter of 2016.
Source: Sadolin & Albæk and the Danish Property Federation.

of properties suffered much sharper falls. The share of vacant properties, the vacancy rate, has been dropping, but remains substantially above the pre-crisis levels, cf. chart 2.6 (right). If price increases are the result of speculative pressures with investors entering the market expecting to realise a gain from future price rises, investors may try to pull out of the market simultaneously if the market turns around. This could lead to increased imbalance between supply and demand and could amplify price fluctuations.

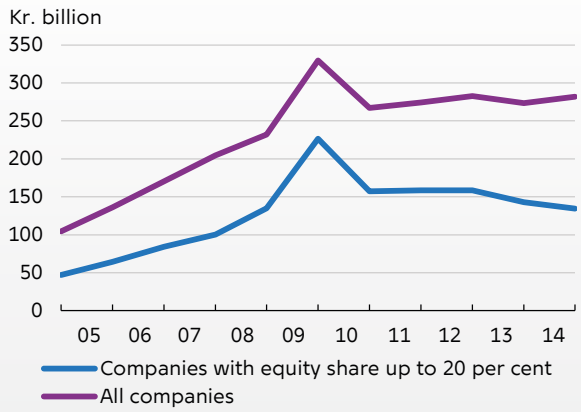
Institutional investors, such as pension companies etc., constitute a large group of investors in the commercial property market, typically through subsidiaries. They tend to have long investment time horizons and resort to loans from credit institutions to fund their investments to a very limited extent only. Foreign investors mainly acquire store properties, presumably because this type of property is expected to be relatively easily marketable. Foreign investors were behind about half of the transactions in the market in 2015.[4]

Market participants do not appear to be more resilient than before the financial crisis

The credit institution debt of Danish property trading and letting companies rose from around kr. 100 billion in 2004 to more than kr. 300 billion in 2009, at the peak of the sector's debt, cf. chart 2.7.

The risk of loss on loans to this sector occurs if companies default and do not have sufficient equity to cover potential property value losses. In case of commercial property price falls of the magnitude seen during the financial crisis, companies need to have equity of more than 20 per cent of their total funding if credit institutions are to avoid losses from default. A large proportion of the sector's debt to credit institutions has been raised by companies with low equity funding. Their share of the sector's total debt surged from 45 per cent in 2004 to 69 per cent in 2009 before falling back to 48 per cent in 2014. Part of the decline may be attributable to the default of some of the most heavily indebted companies since then. With the combination of volatile commercial property prices and a large proportion of the

Debt in property trading and letting companies Chart 2.7



Note: Only companies with positive equity are included. Debt is debt to banks and mortgage banks only.
Source: Own calculations based on data from Experian.

institutions' loans granted to the weakest capitalised commercial property companies, there is considerable risk on loans to this sector. Banks are most exposed to this risk, since the outermost part of the property value is pledged to banks and they thus rank after mortgage banks in case of default.

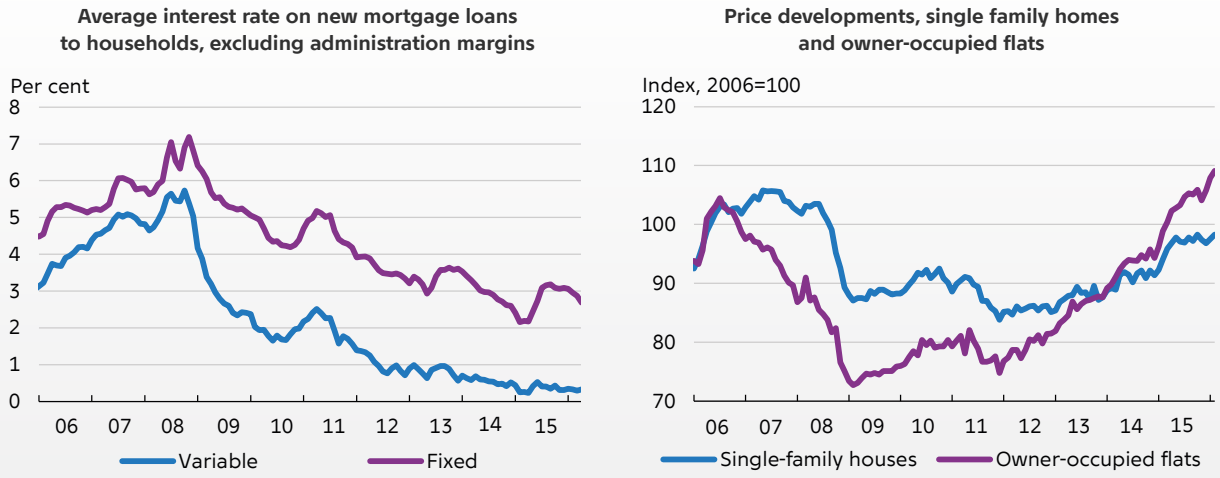
CREDIT RATING OF HOME BUYERS SHOULD ALLOW FOR THE RISK OF SUDDEN HIKES IN INTEREST RATES AND DROPS IN HOUSE PRICES

In the current situation, it is important for the institutions to allow for a sudden rise in interest rates and a fall in asset prices, including house prices, in their credit ratings of customers. The average rate of interest on new mortgage loans has been declining since 2008, and the borrowing costs for home buyers have been very low in recent years, cf. chart 2.8 (left).

The very low interest rates have contributed to a period of strong growth in house prices in some parts of Denmark. Prices of single-family homes have levelled off over the last six months, and turnover has declined, while prices of owner-occupied flats continue to surge, cf. chart 2.8 (right).

4 On 1 January 2016, the Danish Financial Supervisory Authority introduced a new Executive Order on Governance for credit institutions, stating that positive liquidity must be generated in order for loans for mortgaging of commercial properties to be provided. Thus, loans cannot be provided based on expectations of price rises.

Interest rates on new loans from mortgage banks and house prices Chart 2.8



Note: In the left-hand chart, the most recent observations are from April 2016, and in the right-hand chart, the most recent observations are from February 2016.
Source: Danmarks Nationalbank and Statistics Denmark.

Detailed figures for households that bought new homes in the pre-financial crisis years show that institutions granted more high loan-to-income, LTI, loans to home buyers, cf. chart 2.9.[5] A high LTI ratio after a home purchase may be due to credit institutions granting a large loan relative to the home buyer's income, against the home as collateral, or to the home buyer already having substantial other debt relative to his or her income before the home purchase.

In Copenhagen and environs and Northern and Eastern Zealand, subsequently the Copenhagen area, the percentage of home buyers with high LTI ratios increased sharply from 2004 to 2006: 60 per cent of the home buyers in 2006 had LTI ratios higher than 300 per cent and 20 per cent higher than 500 per cent, cf. chart 2.9 (left).[6] The percentage of home buyers with high LTI ratios then fell from 2007 to 2013. A similar trend is found in other parts of Denmark, cf. chart 2.9 (right). Generally, home buyers with high LTI ratios are more common in the Copenhagen area than in other parts of Denmark, while house prices relative to home buyer incomes are highest in the Copenhagen area. The most recent figures for end-2014 show that the percentage of home buyers with high LTI ratios increased relative to 2013.

Excessive risk taking by credit institutions could lead to the build-up of systemic risks, which could be amplified as the Danish economy is expected to reach a normal level of capacity utilisation over the next few years. To address the risk of excessive risk taking, in May 2016, the OECD and the International Monetary Fund, IMF, recommended that the authorities should consider introducing a cap on LTI.

At high debt-to-income ratios, changes in interest rate levels can have a fairly strong impact on home buyers' disposable income, i.e. income after tax and interest payments. This could lead to losses on individual credit institutions' exposures if the home buyers become unable to service the loan. Even if they are still able to service the loan, home buyers may have to cut back on spending to be able to pay. Lower spending by some households could result in fluctuations in total private consumption. This may reduce macroeconomic stability, as was the case in the post-2008 years.[7]

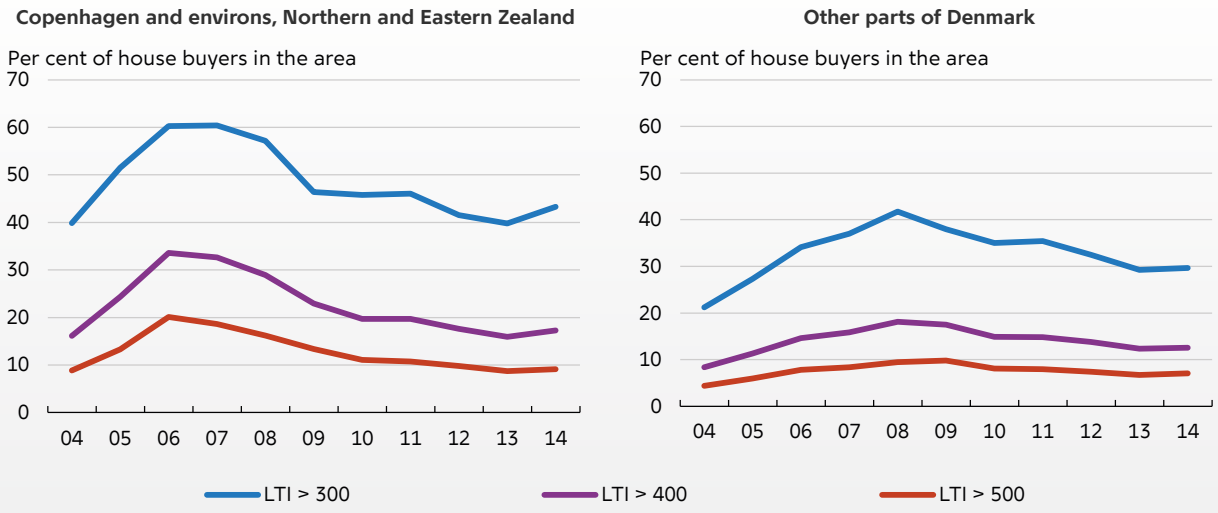
The current combination of economic growth, low demand for new loans and rising house prices may cause credit institutions to ease their credit

5 Home buyers are defined as all families in a given year that have moved house and still have mortgage debt.

6 LTI is calculated as the family's total debt load relative to their gross income in the following year.

7 See Andersen, Asger Lau, Charlotte Duus and Thais Lærkholm Jensen, Household debt and consumption during the financial crisis, Danmarks Nationalbank, *Monetary Review*, 1st Quarter, 2014.

Percentage of home buyers with high loan-to-income, LTI, ratios Chart 2.9



Note: Home buyers are defined as all families in a given year that have moved house and still have mortgage debt. LTI is calculated as the family's total debt load relative to their gross income in the following year. The most recent observations in 2014 are based on a projection.
Source: Statistics Denmark, Danish mortgage banks, and own calculations.

standards again. In the 4th quarter of 2015, the Danish Financial Supervisory Authority conducted a survey of new home loans granted by four small and medium-sized banks in Copenhagen and Aarhus. It gives cause for concern that, according to the survey, the banks in some cases deviate from their credit rating principles. This is in line with the findings of Danmarks Nationalbank's lending survey, which has shown indications of easing of credit standards for non-systemic banks in 2015 due to increased competition.

In January, the Danish Financial Supervisory Authority issued guidelines with credit rating recommendations on mortgaging of homes in growth areas, currently Copenhagen and environs and Aarhus.[8] These guidelines contain recommendations, inter alia, that loans should be issued to borrowers with LTI ratios between 400 per cent and 500 per cent only if they have net wealth which will remain positive after a 10 per cent decrease in the house price. If borrowers have LTI ratios of more than 500 per cent, they should continue to have positive net wealth after a 25 per cent decline in the house price. In 2004 to 2008 all households that bought homes in the period, raised debt totalling about kr. 30 billion, exceeding the limits of the guidelines equivalent to approximately 5 per cent of Danish home buyers' total debt during the period.[9]

The Danish Financial Supervisory Authority's recommendations are based on best practice for the extension of credit by credit institutions. Credit institutions and home buyers should ensure that home buyers are resilient to higher loan costs if interest rates rise. Increased resilience to higher interest rates and falling house prices can be achieved e.g. by choosing longer fixed interest periods or lower debt levels relative to home buyers' income and wealth.

CREDIT INSTITUTIONS ARE ADAPTING TO A NEW REALITY AFTER THE FINANCIAL CRISIS

RISING EARNINGS ARE BOOSTED BY LOW LOAN IMPAIRMENT CHARGES

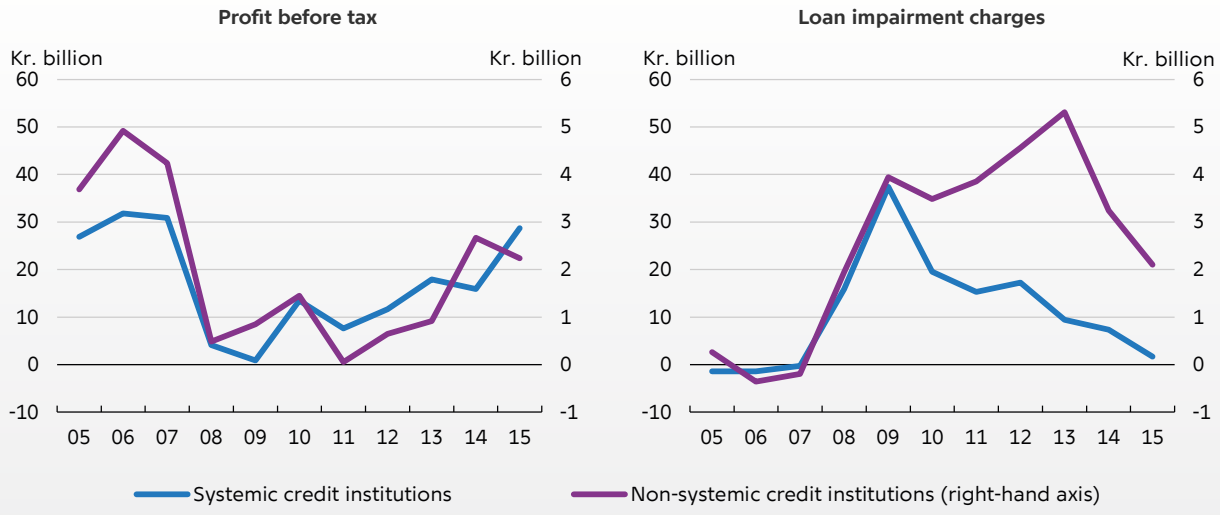
Last year, the systemic credit institutions achieved their highest profit since 2007, cf. chart 2.10 (left). Measured in current prices, earnings are now close

8 In November 2015, the Danish Financial Supervisory Authority also introduced a down payment requirement of 5 per cent of the value of the home.

9 In the calculations, house prices are not impacted by whether or not all credit institutions in the scenarios comply with the guidelines of reducing loans with a high LTI ratio.

Earnings and loan impairment charges

Chart 2.10



Source: Danish Financial Supervisory Authority.

to pre-financial crisis levels. Credit institution earnings were impacted by several large non-recurring items in 2014 and 2015, and the progress from 2014 to 2015 is greater if these items are disregarded.[10]

Last year's increase in earnings was driven primarily by high earnings in the first part of the year when a wave of remortgaging led to an increase in fee income. A review of the systemic credit institutions' financial statements for the 1st quarter of 2016 shows that earnings have declined from the 1st quarter of 2015 due, inter alia, to lower fee and trading income.

Last year's rise in earnings was boosted by a strong decline in impairment charges on loans and guarantees relative to the preceding year, cf. chart 2.10 (right). Most of the fluctuations in the systemic credit institutions' earnings from 2005 to 2015 are attributable to the development in annual loan impairment charges.

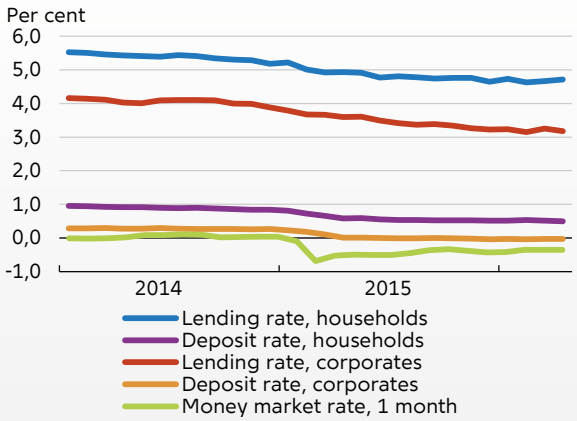
In 2015, the annual loan impairment charge ratio was substantially lower than the average over the last three decades. The current low levels of impairment are to some extent attributable to the fall in new loan impairment charges in recent years due to the improved economic situation. At the same time, some reversal of credit institutions' previous large loan impairment charges is taking place. Total loan impairment charges for the year are consequently reduced by major reversals of previous years' loan impairment charges. It will not be possible to continue this in future, when reversals are expected to be smaller, so loan impairment charges for the year are expected to be higher.

In 2015, the non-systemic banks also achieved the highest profit since the financial crisis. At the same time, developments were also driven by lower loan impairment charges, as they achieved a reduction in loan impairment charges for the year of about kr. 1 billion, or 35 per cent. Their loan impairment charges still account for a larger percentage of total loans and guarantees than is the case in systemic credit institutions.

Loan impairment charges for agricultural sector remain high, accounting for most of the total loan

10 In 2015, Danske Bank booked goodwill impairments of about kr. 4.6 billion on the bank's activities in Finland and Northern Ireland due, among other factors, to downward adjustment of expectations of long-term interest rates, resulting in lower earnings. In 2014, the earnings of systemic groups were impacted by the sale of shares in Nets, Jyske Bank's acquisition of BRFkredit and Danske Bank's goodwill impairments of approximately kr. 9 billion as a result of reassessment of the bank's activities in Finland, Northern Ireland and Estonia.

Banks' average lending and deposit rates Chart 2.11



Note: All average deposit and lending rates in Danish kroner in Denmark, excluding repo loans and deposits. Data covers only deposits and loans in the banking subsidiaries of groups. The most recent observations are from April 2016. Interest rates for February 2016 are adjusted for the leap year effect.
Source: Danmarks Nationalbank.

impairment charges of banks last year. Quite a few farmers are having problems servicing their loans, and if interest rates rise or market prices of their products decrease, even more farmers will see their bottom lines turn red.

CREDIT INSTITUTIONS ARE CHALLENGED BY A SQUEEZED INTEREST MARGIN

While credit institution earnings are bolstered by very low loan impairment charges, their net interest income is under pressure from low demand for new loans and a low interest rate level with negative monetary policy interest rates. Market participants anticipate further monetary policy easing and expect the low interest rate environment to persist for a prolonged period of time.

At the current level of interest rates, deposit rates are adjusted with some lag relative to lending rates, resulting in a lower interest margin.[11] Although money market interest rates are in negative territory, the average household deposit rate was around 0.5 per cent in April 2016, cf. chart 2.11. While the rate of interest on most household demand deposits is 0 per cent, around 15 per cent of household demand deposits are linked to mortgage-like loan agreements, for which the rate of interest is approximately 2.2 per cent. Demand deposits account for about 70 per cent of total household deposits, while the remaining deposits are mostly time deposits, including pension savings with banks, for which interest rates may be high due to the investment return on the pension plan.

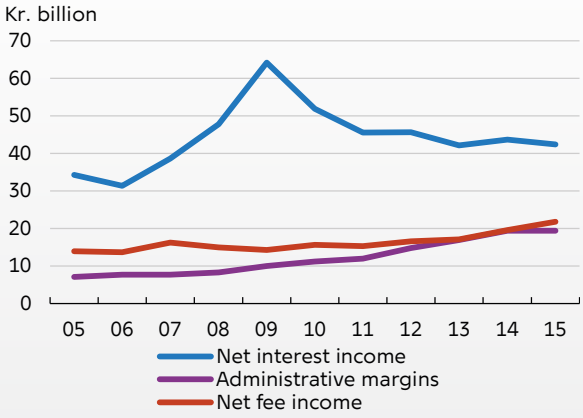
The average deposit rate for the corporate sector was close to 0 in 2015-16, while major corporate customers and many financial corporations have to pay for deposits at banks.

Banks' lending rates have been declining in recent years when money market rates have also fallen. The reason for the drop in lending rates could also be that in the institutions' assessment, the credit risk on their exposures is lower, and hence they have reduced the risk premium to cover borrowers' default on the interest rate exposure. The risk premium must regularly cover the expected future loss over the entire loan term.

Higher net fee income makes up for lower net interest income

While the net interest income of the systemic credit institutions is under pressure, fee income and administration margins account for increasing proportions of the institutions' income, cf. chart 2.12. Last year, developments in the financial markets affected the net fee income of the institutions in several ways. The exceptionally high level of activity

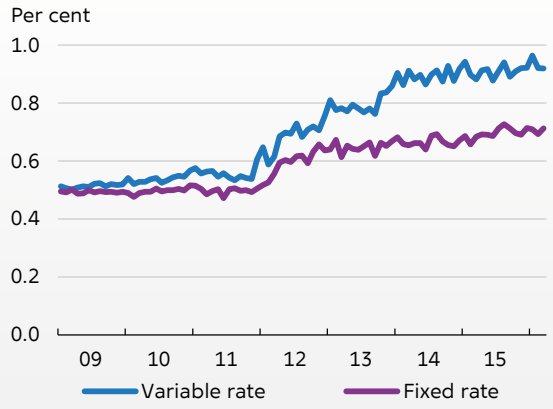
Net interest income, income from administration margins and net fee income in systemic credit institutions Chart 2.12



Source: Danish Financial Supervisory Authority and own calculations.

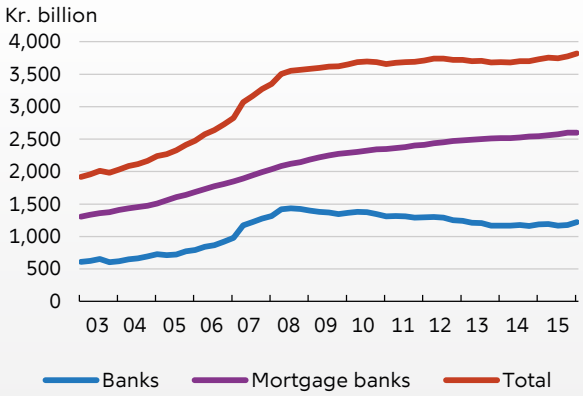
11 A bank earns net interest income, inter alia, by setting the rate of interest on loans higher than the interest rate on deposits and other sources of funding. The spread between its average lending and deposit rates is known as the interest margin.

Mortgage banks' average administration margins for new loans Chart 2.13



Note: The chart shows average administration margins on new loans to Danish households in Danish kroner. The most recent observations are from April 2016.
Source: Danmarks Nationalbank.

Lending by credit institutions Chart 2.14



Note: The chart contains loans to households and corporate customers in Denmark and abroad. The most recent update is from March 2016.
Source: Danmarks Nationalbank.

in the foreign exchange market at the beginning of the year led to higher earnings from exchange rate hedging transactions in the systemic credit institutions, while the simultaneous fall in interest rates resulted in an increase in the volume of remortgaging.

Income from fees declined in the 2nd half of the year, and the financial statements of the systemic credit institutions for the 1st quarter of 2016 also show a fall relative to the 1st quarter of 2015.

Income from administration margins payable on mortgage loans has been going up, and the rise since 2010 mainly reflects higher administration margins, cf. chart 2.13. At the same time, administration margins have become more differentiated, as the margins for adjustable rate loans have increased more than for fixed rate mortgage loans. Increased differentiation ensures better coherence between price and risk on the various types of mortgage loans. In 2016, some mortgage banks have announced that they will increase their administration margins further.

Against the backdrop of rising administration margins, the Minister for Business and Growth set up a committee of experts in March to look into the possibilities of strengthening transparency and mobility in the mortgage market and provide recommendations on necessary adjustments of the rules applying to the mortgage sector. The committee of experts is expected to make an assessment in September 2016.

INSTITUTIONS MUST ADAPT TO A SITUATION OF LOW DEMAND FOR NEW LOANS

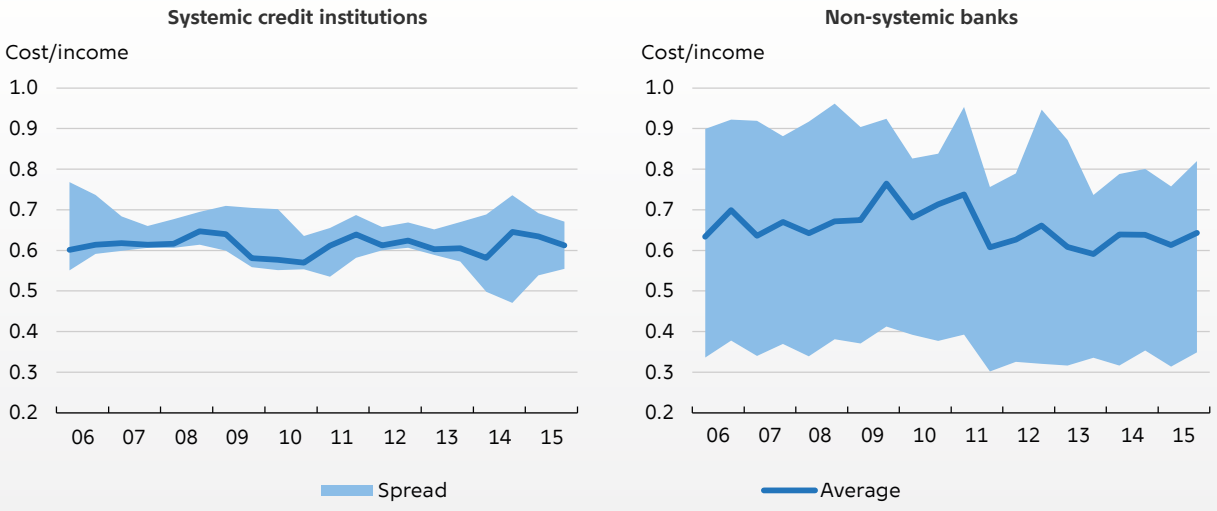
Prospects of continued low interest rates and limited domestic demand for new loans weigh on credit institutions' earnings potential. The flat trend in total lending masks stagnant bank lending and continued increases in mortgage bank lending, cf. chart 2.14.

The continued high debt levels and high savings of households and firms may contribute to the future demand for loans remaining low. This is reflected in Danmarks Nationalbank's lending survey, in which the institutions' credit managers assess that demand for new loans remains limited.

The current lending growth and forward-looking expectations of limited demand for new loans in Denmark could prompt credit institutions to turn to new markets in search of lending growth. Rapid lending growth in new markets can make it particularly challenging to ensure sufficient credit standards for new loans.

Last year, Danske Bank significantly expanded its business volumes in Sweden and Norway, also compared with other banks operating in the Swedish and Norwegian markets. Danske Bank has a strategic objective of achieving further growth in these two markets and aspires e.g. to set up a local mortgage bank in Sweden. Against this backdrop, the Danish Financial Supervisory Authority reviewed selected new loans by Danske Bank in Norway and Sweden, respectively, in October and December

Cost-to-income ratio Chart 2.15



Note: The charts show moving averages from the two most recent interim reports. Income consists of net interest and fee income, other operating income, income from investments in associates and group enterprises and income from discontinuing operations. Costs consist of staff costs and administrative expenses, depreciation, amortisation and impairment of intangible and tangible assets and other operating expenses. The average is calculated as the institutions' total cost to total income ratios, and the spread shows the difference between the institution with the highest and lowest cost ratio. The most recent observations are from end-2015.
Source: Danish Financial Supervisory Authority and own calculations.

2015. On this basis, the Authority provided two risk disclosure statements, pointing out that, in the current situation, Danske Bank has increased risk of incurring future losses with its chosen growth strategy.

In Sweden and Norway, total lending has been growing over a number of years, especially for financing of homes and commercial properties. Both Sweden and Norway have seen substantial increases in house prices for several years. In the assessment of IMF, the housing markets of both countries are considerably overrated, and the OECD also suggests that prices seem to be too high. The Norwegian economy may be negatively impacted by low oil prices, also in the future.

Capacity adjustment in credit institutions

If lending growth remains limited, this may create a need for further adjustment of credit institutions' capacity, with focus on reducing costs and increasing efficiency. Over the last decade, the systemic credit institutions' cost-to-income ratio has remained virtually constant, cf. chart 2.15 (left). This is despite the fact that several of the institutions reduced staff and closed down branches in the wake of the financial crisis. In 2014-15, the costs of some institutions were pushed up by high goodwill impairment charges. The average cost-to-income ratio of the non-systemic banks has also remained largely constant since 2006, although the spread is wider than for the systemic credit institutions, cf. chart 2.15 (right).

A previous analysis of productivity and cost efficiency shows that some Danish credit institutions were fully able to match the most efficient foreign banks in terms of cost efficiency, while some small credit institutions were lagging behind.[12] The ongoing reduction in the number of credit institutions in Denmark in recent decades has helped to increase productivity in the sector, given that institutions that defaulted or were acquired by other institutions were generally less cost efficient than the remaining institutions.

The number of credit institution staff has been decreasing since the early 1980s, while the amount of loans at constant prices has increased substantially. Thus, overall, credit institutions are

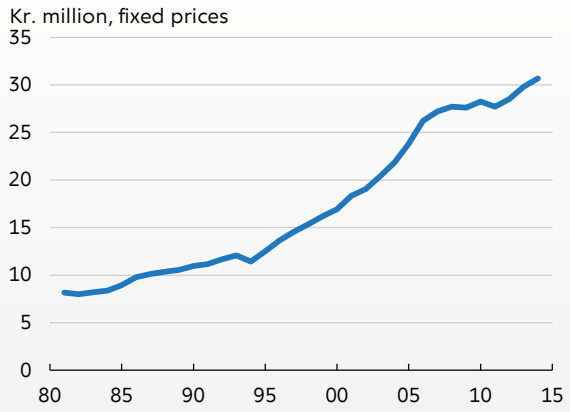
12 See Abildgren, Kim, Nicolai Møller Andersen, Mark Strøm Kristoffersen and Andreas Kuchler, Productivity and cost-efficiency in the Danish financial sector, *Monetary Review*, 4th Quarter, Part 2, 2013.

currently able to provide a much higher volume of credit per employee than previously.

There is some degree of stickiness in the adjustment of the institutions' resource utilisation (for instance staff) to developments in customer demand for financial services (such as loans). Therefore, the number of loans per employee has increased the most in periods of high lending growth, as staff numbers have only begun to rise after a lag of a few years, cf. chart 2.16. Since 2008, loan volumes have not increased substantially, and in recent years the number of staff has also been reduced. Institutions are likely to continue their focus on capacity adjustment in the coming years e.g. in terms of the number of employees and branches.

The loans per employee indicator cannot reflect all aspects of value creation in credit institutions. If, say, employees contribute more to the value creation of banks than previously through activities other than granting loans, e.g. trading in financial markets and asset management, the indicator will underestimate developments in bank cost efficiency.

Credit institutions' domestic loans per employee Chart 2.16



Note: The chart is deflated by the development in the consumer price index. The most recent observations are from end-2014.
Source: Danish Financial Supervisory Authority; Abildgren, Kim, Nikolai Møller Andersen, Mark Strøm Kristoffersen and Andreas Kuchler (2013), Productivity and cost-efficiency in the Danish financial sector, Danmarks Nationalbank *Monetary Review*, 4th Quarter, Part 2, and own calculations.

NEW ACTORS IN THE PAYMENTS MARKET

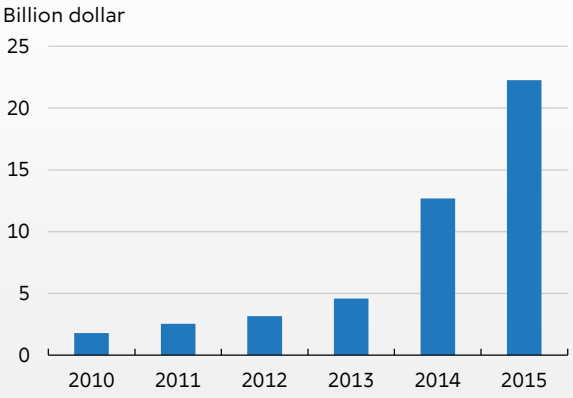
The financial sector and its services are becoming increasingly digitised these years. The Danish banking sector is investing heavily in IT and new digital solutions. However, digitisation is also providing new business opportunities for non-bank providers of financial services who have attracted major investments from international investors, cf. chart 2.17. These financial technology – fintech – companies offer services within e.g. lending, credit rating and budget management.

Payments are one of the fastest evolving areas. Historically, credit institutions and credit institution-owned companies have been the primary providers of payment solutions such as the Dankort, Betalingsservice (direct debit) and credit transfers. This is because a number of payment services are based on deposit accounts, which may only be held by banks.

In recent years, other types of firms have begun to launch their own payment solutions, either in competition with existing providers or in partnership with one or more banks. These firms have payment systems as their primary business area.[13] In addition, large global companies provide payment services mainly to support their primary business activity, for instance selling of own goods or services or provision of a service via an online platform.[14]

So far, the increasing digitisation in recent years has brought very few new actors to the Danish pay-

Global investment in financial technology (fintech) companies Chart 2.17



Source: Accenture, *Fintech and the evolving landscape*, 2016.

13 The firms Paypal and iZettle are examples of firms with a business focus on digital payment systems.

14 Examples are large technology companies such as Apple, Facebook and Google.

ments market. This may reflect the size of the market and the fact that Denmark has its own currency.

In recent years, Danish credit institutions and Nets have launched several new digital payment initiatives such as the Mobilepay and Swipp mobile payment services and Dankort cards with contactless technology.

The widespread popularity of these solutions shows that this is a dynamic area which could rapidly undergo significant changes. Credit institutions have limited direct earnings from payment systems, but if their role as payment provider is weakened, their earnings from other, more profitable, business may also come under pressure.

CREDIT INSTITUTION CAPITAL REQUIREMENTS

ALL SYSTEMIC CREDIT INSTITUTIONS COMPLY WITH CAPITAL REQUIREMENTS ALREADY ADOPTED

All systemic credit institutions have substantial excess capital adequacy relative to the current requirements. This helps to ensure that they have sufficient capital for absorbing any future losses that will not be covered by current earnings.

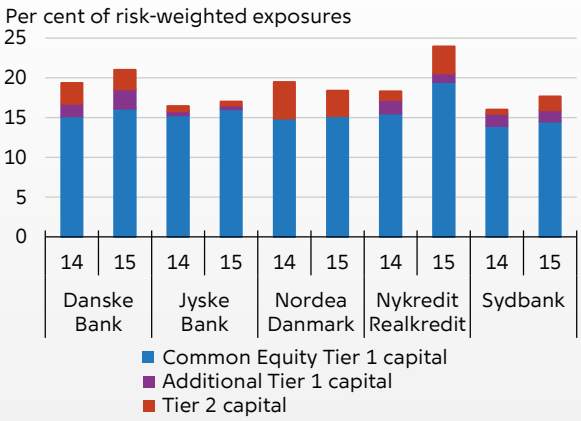
The Common Equity Tier 1 capital ratio rose for all systemic credit institutions in Denmark from 2014 to 2015, while the total capital base increased in four out of five institutions, cf. chart 2.18.

Danske Bank, Jyske Bank and Sydbank have announced share buyback plans totalling about kr. 10 billion in 2016. If these buybacks are deducted in the calculation of Common Equity Tier 1 capital at end-2015, the Common Equity Tier 1 capital ratios of these institutions were virtually unchanged from 2014. The share buybacks should be seen in the context that, at end-2015, the Common Equity Tier 1 capital ratios of the institutions were higher than their targets.

The large increase in Nykredit's capital base since 2014 is the result of retained earnings and a decrease in calculated risks on exposures. Nykredit states that risk-weighted exposures are expected to increase by about 10 per cent due to a number of changes to the models used for calculating risk-weighted exposures. The model changes are awaiting approval from the Danish Financial Supervisory Authority.

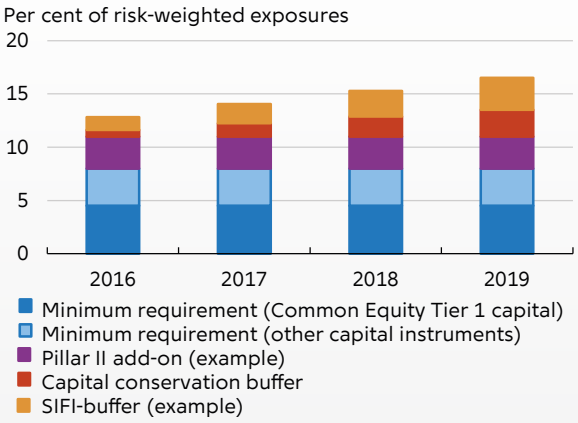
The capital requirements for credit institutions will be gradually tightened towards 2019, when

Capital base of selected systemic credit institutions Chart 2.18



Note: The calculation is performed at year-end. The capital base does not take transitional rules until 2021 into account.
Source: Danish Financial Supervisory Authority and own calculations.

Example of adopted capital requirements and their phasing-in for a systemically important institution, SIFI Chart 2.19



Note: The minimum requirement for the capital base consists of a requirement of at least 4.5 per cent Common Equity Tier 1 capital and 3.5 per cent other types of capital, Additional Tier 1 capital constituting up to 1.5 per cent and Tier 2 capital constituting up to 2 per cent. The capital conservation buffer requirement gradually increases to 2.5 per cent until 2019, and the SIFI capital buffer amounts to 1-3 per cent. All buffers must be covered by Common Equity Tier 1 capital. By the beginning of 2022, the Pillar II add-on of credit institutions must consist of at least 56 per cent Common Equity Tier 1 capital and at least 75 per cent Tier 1 capital. All capital requirements can be met using Common Equity Tier 1 capital rather than other types of capital.
Source: Own calculations.

the EU will phase in a number of capital requirements already adopted, cf. chart 2.19. This will be achieved e.g. by phasing in a capital conservation buffer for all credit institutions starting this year. Since last year, systemically important financial institutions, SIFIs, have also been subject to a SIFI capital buffer, the size of which depends on the group's systemic importance. In addition, a countercyclical buffer was introduced last year, but it is currently set at 0 per cent.

At end-2015, all systemic credit institutions complied with the fully phased-in 2019 capital requirements. However, the institutions will not necessarily comply with the requirements in 2019, since capital, assets and asset composition may change in the period up to 2019. Moreover, the Minister for Business and Growth could increase the countercyclical capital buffer.

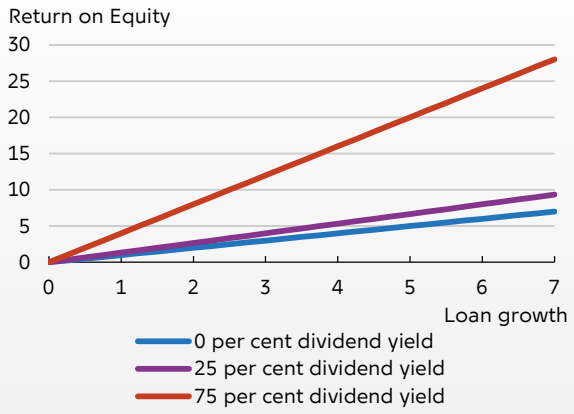
COMBINATION OF LIMITED LENDING GROWTH AND A HIGH DIVIDEND RATE COULD WEAKEN BANKS' RESILIENCE

If a credit institution increases lending or other exposures, the institution will need to increase its equity to maintain its current excess capital adequacy. This also applies if the calculated risk on some of the institutions' exposures increases, either due to actual portfolio changes or as a result of changes in calculation method requirements. The Basel Committee has proposed strengthening requirements for the calculation of both credit and market risks which, along with operational risks and counterparty risks, constitute the total risk-weighted exposures of a credit institution. The Committee's revised market risk standard may substantially increase the risk-weighted market risk exposures of banks with large trading books. Box 2.2 reviews the revised standard and its possible implications for Danish credit institutions. The proposed changes for the calculation of credit risk are described in detail in Chapter 4.

If an institution distributes a substantial portion of its earnings to the group of owners or buys back shares, the capital ratio may quickly be reduced. For instance, if an institution's loans grow by 3 per cent annually and the institution distributes 75 per cent of the net profit for the year to its shareholders or implements a share buyback programme with a corresponding impact, the return on equity (ROE) after tax must be 12 per cent – just to keep the capital ratio constant. If, instead, the institution distributed 25 per cent of the net profit for the year, its ROE after tax should be only 4 per cent to keep the capital ratio constant, cf. figur 2.20. In recent years, several systemic credit institutions have set high targets for return on equity, which is analysed in more detail in Chapter 3.

Relationship between return on equity (ROE) and lending growth at a constant capital ratio

Chart 2.20



Note: The chart is based on a very simplified credit institution in which all assets consist of loans with the same risk weight, and the entire capital base consists of booked equity. Return on equity is after tax.
Source: Own calculation.

SYSTEMIC BANKS ARE ABLE TO COMPLY WITH THE CURRENT CAPITAL REQUIREMENTS EVEN UNDER SEVERE STRESS CONDITIONS

In a severe recession scenario, all Danish systemic banks will still have considerable excess capital adequacy in relation to the minimum requirements in 2018, cf. chart 2.21 (left). This is demonstrated by Danmarks Nationalbank's accounts-based stress test, which assesses the banks' excess capital adequacy over the next three years under various macroeconomic scenarios. The stress test covers only the banking activities of a group – not any other business areas such as affiliated mortgage banks. Box 2.3 provides a description of the stress test model, the scenarios applied and the definitions of the two stress test capital requirements (the red and yellow requirements).

In a severe recession scenario, some systemic banks will have a small capital shortfall relative to the total capital requirement, including buffers, in 2018, cf. chart 2.21 (right). In 2018, the capital

New Basel standard for market risk

Box 2.2

In January, the Basel Committee issued a revised standard for minimum capital requirements for market risk. This standard incorporates proposals for fundamental changes to the determination of market risk made following the Committee's issuance of the consultative document "Fundamental Review of the Trading Book". The committee has set 1 January 2019 as the deadline for the standard to be implemented. The European Commission has announced that it will soon conduct a hearing on the potential impacts for the European banking sector.

Market risk is defined as the risk of losses arising from movements in market prices. The risks subject to market risk capital charges include:

- Default risk, interest rate risk, credit spread risk, equity risk, foreign exchange risk and commodities risk for trading book instruments; and
- Foreign exchange risk and commodities risk for banking book instruments.

A credit institution's capital requirements must cover various types of risk: credit risk, counterparty risk, operational risk and market risk. Market risk accounts for approximately 10 per cent of the total capital requirements for the systemic credit institutions.

Changes to the determination of market risk

In determining their market risk for regulatory capital requirements, institutions may still choose between two broad methodologies: the standardised approach and internal models approach for market risk. The use of internal models will be conditional upon explicit approval from the bank's supervisory authority. The choice between the two approaches is independent of whether the banks use internal models for determining the capital requirement in other risk areas, for instance in relation to credit risk for positions held in the banking book. Few Danish banks are currently using internal models to determine their capital requirements for market risk.

The new Basel standard introduces five major changes relative to previous rules:

- *A revised boundary between the trading book and banking book.* Establishment of a more objective boundary will serve to reduce incentives to arbitrage between the regulatory banking and trading books and provide more supervisory tools to help ensure more consistent implementation of the boundary across banks. The standard provides directional guidelines for instruments that belong in the trading book, instruments that belong in the banking book and instruments that would customarily belong in the trading book unless the bank provides evidence otherwise. Supervisors may also require the bank to reassign an instrument if the supervisors believe it has been assigned to the wrong book.
- *Revised standardised approach*. The revisions fundamentally overhaul the standardised approach to make it more risk sensitive. The capital requirement is the sum of three components: the risk charges under the sensitivities based method (based on standardised delta, vega and curvature parameters), the default risk charge, and the residual risk add-on for instruments subject to risks that are not addressed by the first two components (e.g. exotic instruments).
- *A revised internal models approach*. The new approach introduces a more rigorous model approval process which assumes that the individual trading desk[1] can satisfy a number of minimum backtesting and profit and loss attribution requirements. If a trading desk does not satisfy these requirements, it must adopt the standardised approach. The revised method also entails a shift from *Value-at-Risk* to *an Expected Shortfall* measure of risk under stress. Use of *Expected Shortfall* will help to ensure a more prudent capture of tail risk and capital adequacy during periods of significant financial market stress. The capital requirement is an aggregation of *Expected Shortfall*, the *Default Risk Charge* and an add-on for non-modellable risks.
- *Incorporation of the risk of market illiquidity*. Varying liquidity horizons are incorporated into both approaches to mitigate the risk of a sudden and severe impairment of market liquidity. These replace the static 10-day horizon assumed for all traded instruments under *Value-at-Risk* in the current framework.

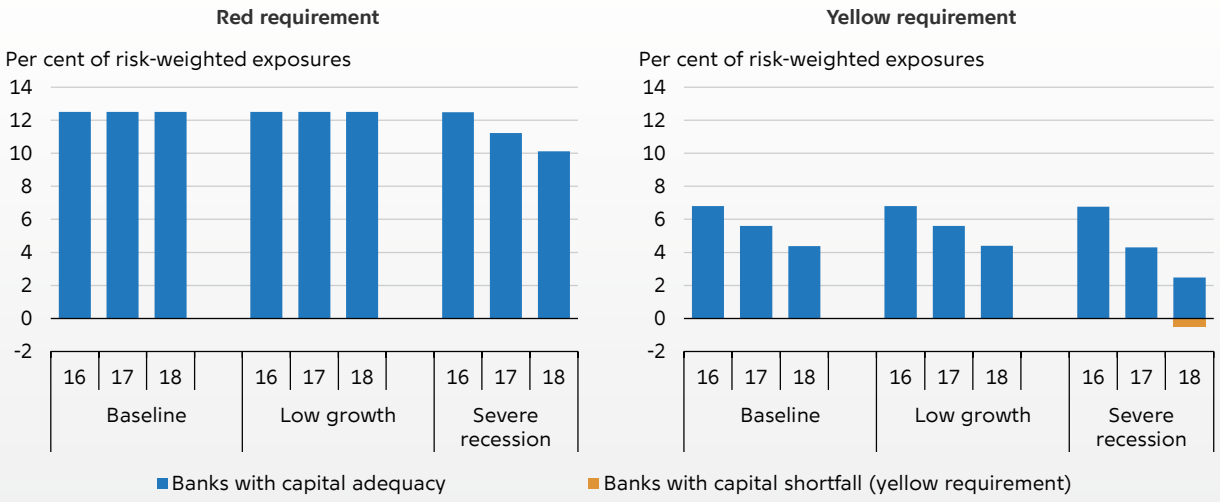
In the assessment of the Basel Committee, the capital requirements are strengthened with the revised standard

The revised standard may entail a substantial increase in capital requirements for market risk. However, considerable variation in impacts across various banks is to be expected. The Basel Committee has conducted several impact studies of the underlying proposals. For the internal models approach, calculations performed on a sample of 12 banks with large trading books and high data quality show that capital requirements for market risk will increase by 28 per cent (median) relative to the current approach. However, calculations performed on a broader sample of 44 banks (allegedly with lower data quality) show a fall of 3 per cent (median) in capital requirements for market risk determined using the internal models approach.

For the standardised approach, calculations performed on a sample of 21 banks show that capital requirements for market risk will increase by 80 per cent (median).[2]

1. A trading desk is a separately managed business line within a bank that follows defined trading strategies with certain instruments, with the goal of generating revenues or maintaining market presence while assuming and managing risk.
2. The impact studies mentioned exclude any securitisation positions. .

Excess capital adequacy or capital shortfall of systemic banks in accounts-based stress test Chart 2.21



Note: Excess capital adequacy or capital shortfall as a percentage of the systemic banks' total risk-weighted exposures. The stress test is based on financial statements from end-2015.
Source: Danish Financial Supervisory Authority and own calculations.

shortfall amounts to kr. 6 billion, equivalent to 0.5 per cent of total risk-weighted exposures. In the event of non-compliance with the buffer requirements, the Danish Financial Supervisory Authority has imposed a number of limitations on the institution's activities, e.g. limitations of dividend payments. Moreover, the institution should expect that its access to external funding in the financial markets may be challenged if the buffer requirements are not met.

In the severe recession scenario of Danmarks Nationalbank's accounts-based stress test, several non-systemic banks will have a substantial capital shortfall – both in relation to their minimum requirements and the requirement including buffers, cf. chart 2.22. The institutions breaching the minimum requirements in a severe recession have a combined capital shortfall of kr. 4 billion in 2018, corresponding to 2 per cent of their risk-weighted exposures. The combined capital shortfall relative to the capital requirements including buffers is around kr. 8 billion in 2018, corresponding to 4 per cent of their risk-weighted exposures.

Non-systemic banks will be greatly challenged in a severe recession scenario under which several of the banks will, in the first instance, fail to comply with the minimum requirements after three years. Before it comes to that, breach of the buffer requirements will enable the Danish Financial Supervisory Authority to intervene. The authorities have sufficient tools to address this situation, and therefore it is not assessed to be a risk to financial stability. However, the owners and creditors of the banks affected may incur large losses if the banks are to be restored to health or resolved.

ACCORDING TO MARKET-BASED STRESS TEST, PRICE FALLS LEAD TO LOWER CAPITALISATION OF CREDIT INSTITUTIONS

The equity market's forward-looking assessment of credit institutions can be used to get an indication of the market's view of the institutions' resilience under stress. Hence, the equity market's assessment may supplement Danmarks Nationalbank's accounts-based stress test. For that purpose, Danmarks Nationalbank uses the systemic risk measure SRISK. SRISK is a market-based stress test, based on the equity prices of listed credit institutions and estimates of the fall in their equity prices in a severe stress scenario. The stress scenario includes an equity market drop of a mini-

Danmarks Nationalbank's accounts-based stress test model and stress scenarios

Box 2.3

Based on Danmarks Nationalbank's accounts-based stress test model, Danmarks Nationalbank assesses Danish banks' capitalisation in three macroeconomic scenarios. Five systemic and 11 non-systemic banks are included in the stress test. Between them, these banks account for more than 90 per cent of total lending by Danish banks.[1]

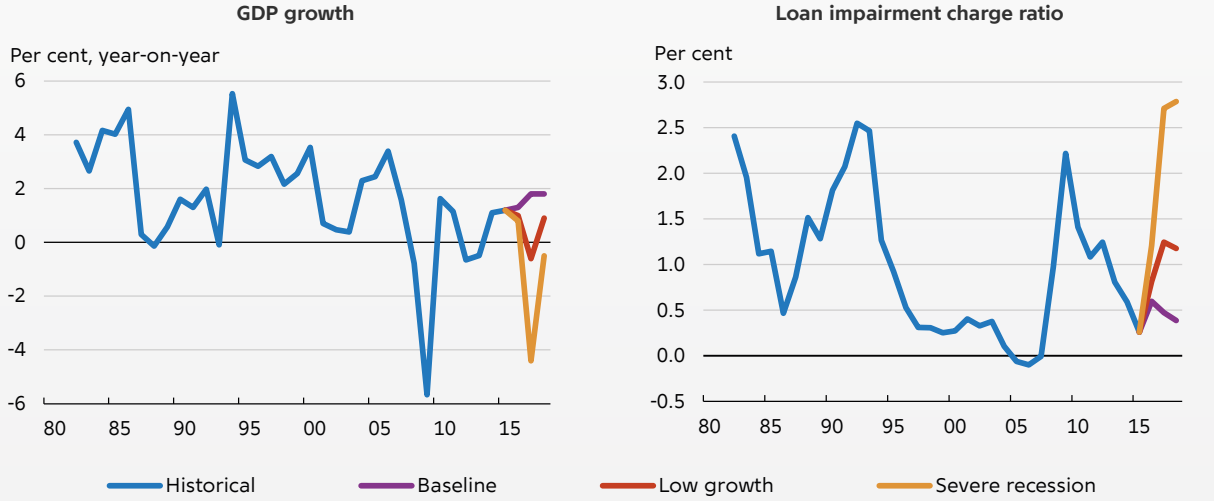
The macroeconomic scenarios of the stress test

The stress test is based on the banks' financial statements for 2015. The income statements and balance sheets are projected until and including 2018 in three macroeconomic scenarios: a baseline scenario, low growth and severe recession, cf. Chart A. The scenarios have been developed in cooperation with the Danish Financial Supervisory Authority.

The baseline scenario is based on Danmarks Nationalbank's macroeconomic projection, cf. *Monetary Review*, 1st Quarter 2016. The low growth scenario implies weak development in economic activity, cf. Chart A (left), with rising unemployment, falling private consumption and house prices, which are developing less favourably than in the baseline scenario. The severe recession scenario reflects a global shock to business and consumer confidence. Export market growth declines sharply and consumer confidence contracts, resulting in falling private consumption and house prices. At end-2018, house prices are 24 per cent lower than in the baseline scenario. Selected key variables for the scenarios are set out in Appendix 2.

Loan impairment charges increase in the scenarios with stress, particularly in the severe recession scenario, where the loan impairment charge ratio is higher than in any year since 1982, cf. Chart A (right). In the stress test, the banks' capitalisation is affected primarily by loan impairment charges, while other factors such as interest rate developments and value adjustments matter less. The banks' risk weights in the projection are constant, and higher funding costs due to weaker capitalisation in stress scenarios are not taken into account.

Chart A. GDP growth and annual loan impairment charge ratios



Note: In the right-hand chart, loan impairment charges are calculated as a ratio of lending and guarantees before loan impairment charges. The historical series until and including 2015 is based on banks in the Danish Financial Supervisory Authority's groups 1-3. The estimated loan impairment charge ratios for 2016-18 have been calculated as a weighted average of the 16 banks in the stress test.

Source: Cato Baldvinsson, Torben Bender, Kim Busch-Nielsen and Flemming Nytoft Rasmussen, Dansk Bankvæsen (Danish banking – in Danish only), 5th edition, Forlaget Thomson (2005), Danish Financial Supervisory Authority, Statistics Denmark and own calculations.

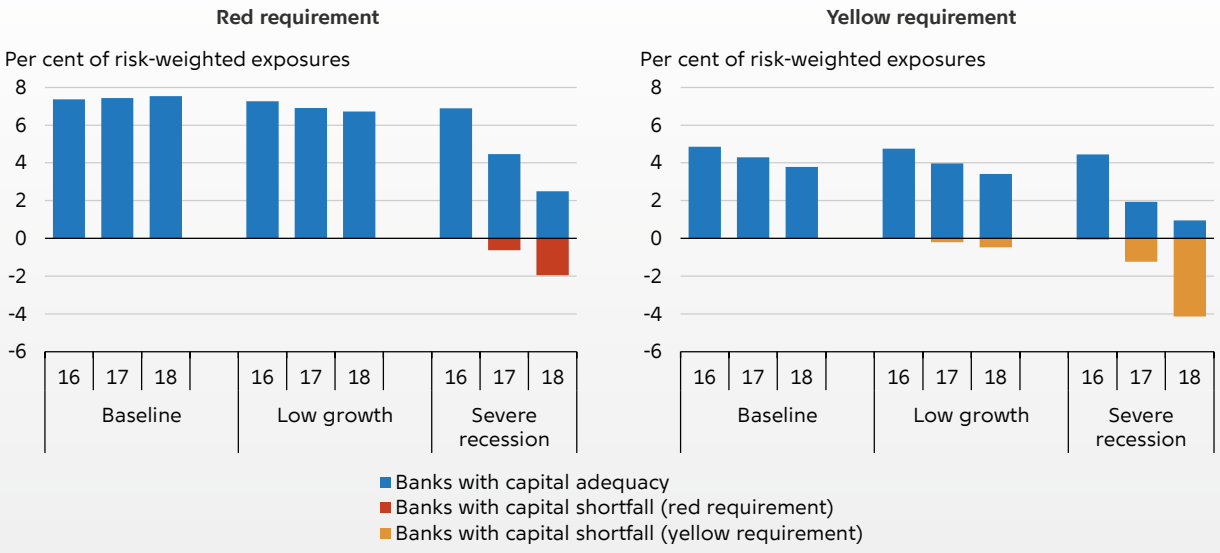
Capitalisation

In the accounts-based stress test, the banks' capital in the projection period is compared with two capital requirements, a "red" and a "yellow" requirement. The red requirement is the statutory minimum requirement, cf. Chart 2.19. A bank is required to hold Common Equity Tier 1 capital of more than 4.5 per cent of its risk-weighted exposures and Tier 1 and capital base ratios of at least 6 and 8 per cent. A bank can issue other types of capital to meet the minimum requirements in addition to 4.5 per cent Common Equity Tier 1 capital. The stress test assumes that a capital shortfall will be covered by Common Equity Tier 1 capital, as this is fully loss-absorbing. The yellow requirement of the stress test is the red requirement plus the Pillar II add-on, the capital conservation buffer and, for systemically important institutions, SIFIs, also a SIFI capital buffer, cf. Chart 2.19.

1. The structure, assumptions and capital requirements of the stress test model are detailed in "Technical Appendix: Danmarks Nationalbank's stress test", Danmarks Nationalbank, *Financial stability*, 1st Half 2015. Appendix 1 contains an overview of the banks included in the stress test.

Excess capital adequacy or capital shortfall of non-systemic banks in accounts-based stress test

Chart 2.22



Note: Excess capital adequacy or capital shortfall as a percentage of the non-systemic banks' total risk-weighted exposures. The stress test is based on financial statements from end-2015.
Source: Danish Financial Supervisory Authority and own calculations.

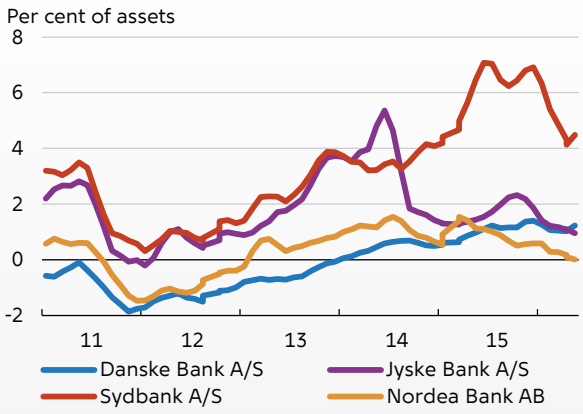
mum of 40 per cent over six months.[15] In SRISK, the institutions' capitalisation under stress is assessed relative to a level of 3 per cent of total assets.[16] If, according to SRISK, the capitalisation of an institution is higher (lower) than this level, the institution has positive (negative) excess capital adequacy in the stress scenario. The calculations cover the three listed Danish institutions Danske Bank, Jyske Bank and Sydbank as well as the Swedish institution Nordea AB. The stress test covers the entire group, i.e. both its banking and mortgage banking activities and other business areas.

According to SRISK, the listed systemic credit institutions currently have positive excess capital adequacy in a severe stress scenario, cf. chart 2.23. The excess capital adequacy in a stress situation has increased considerably for all institutions since 2011. However, this trend seems to have reversed during 2015 and 2016.

According to SRISK, the general increase in the institutions' excess capital adequacy since

Excess capital adequacy of credit institutions according to SRISK

Chart 2.23



Note: 3-month moving averages. The value of the assets is measured as the market value of the institution's equity plus the book value of its other liabilities. The excess capital adequacy is calculated as the market-based capitalisation relative to a level of 3 per cent of the institution's total assets. The chart shows, at any given time during the period 2011-2016, the estimated excess capital adequacy six months ahead in case of a 40 per cent fall in Stoxx Europe 600. The excess capital adequacy estimation is described in more detail in Grinderslev, Oliver J. and Kristian L. Kristiansen (2016), Systemic Risk in Danish Banks: Implementing SRISK in a Danish Context, Danmarks Nationalbank, *Working Paper* No. 105. The most recent observations for financial statements are from the 1st quarter of 2016 and for equity prices 27 May 2016.
Source: Bloomberg, SNL Financials and own calculations.

15 By comparison, the Stoxx Europe 600 stock index contracted by 42 per cent from August 2008 and six months ahead.

16 All institutions are faced with the same capital level of 3 per cent of their non-risk weighted assets. The value of the assets is measured as the market value of an institution's share capital plus the book value of its other liabilities.

Price fall leads to lower credit institution capitalisation in market-based stress test

Box 2.4

According to Danmarks Nationalbank's systemic risk measure, SRISK, overall capitalisation has declined in 2016, cf. Chart A. The four institutions Danske Bank, Nordea AB, Jyske Bank and Sydbank all still have positive excess capital adequacy in relation to the stress test level of 3 per cent of total assets.[1]

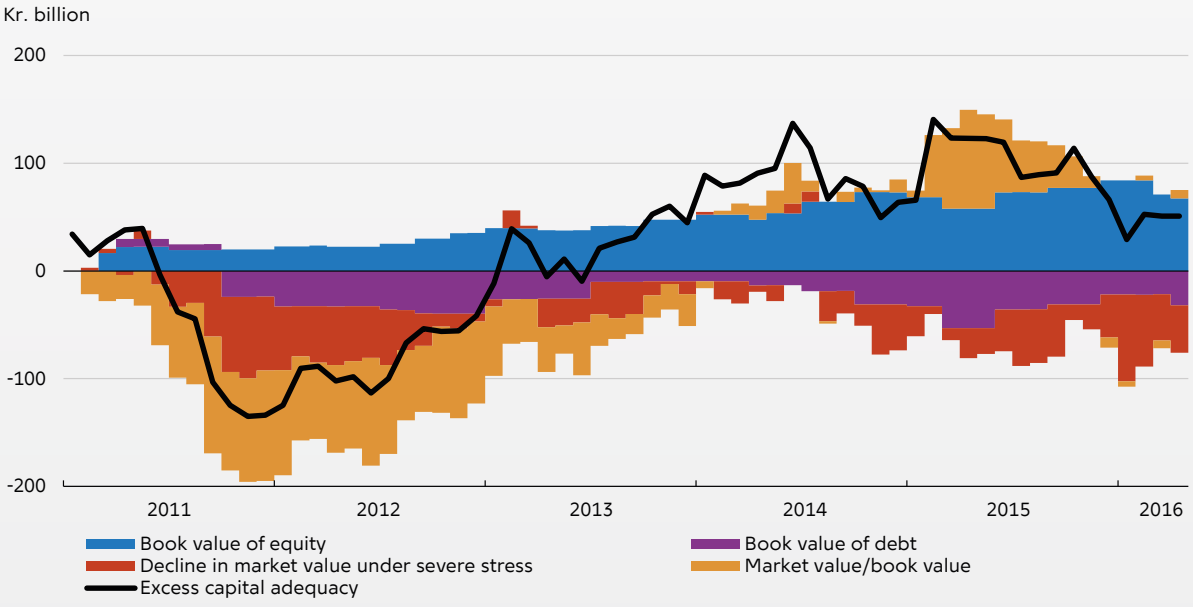
Declining equity prices and a sharp drop in the market value under the model's stress scenario have reduced the institutions' market-based capitalisation. This box explains the underlying factors driving SRISK developments.

In the stress test, changes in capitalisation can be decomposed into developments in four underlying factors:

- Equity calculated at book value. More equity reduces the groups' leverage and contributes positively to market-based capitalisation.
- Debt calculated at book value. More debt increases the groups' leverage and contributes negatively to capitalisation.
- Market value of the groups' equity relative to the book value of equity. A lower ratio reflects a more negative view among market participants of the institution's future earnings potential and/or reflects that market participants consider the capitalisation of the institutions to be weak in case of stress.
- Estimated decline in the market value of listed equities in a severe stress situation. The stress scenario is a decrease of at least 40 per cent in the Stoxx Europe 600 stock index over six months. European equity market declines of this magnitude will probably coincide with major challenges in the financial sector and/or recession in the real economy. The stress scenario contributes negatively to capitalisation. The fall in market value in the stress scenario is determined using a dynamic econometric model that models the covariation between the development in each group's equity prices and the equity market. Capitalisation tends to fall more rapidly, the larger the institution, given that the situation of major institutions often tracks economic developments and the rest of the equity market more closely than that of small institutions.

According to SRISK, the fall in excess capital adequacy seen in 2016 is driven, in particular, by the decrease in the market value of the institutions' equity relative to the book value of equity. Bank equities have depreciated more than other equities, both internationally and in Denmark. Sydbank's equities have fallen relatively more than the equity prices of other banks in 2016, but, on the other hand, they rose more at the beginning of 2015. Higher estimated drops in the value of the institutions' assets in a stress scenario further reduced the excess capital adequacy from November 2015 to February 2016, but this impact has subsequently declined. Accounting factors have not contributed to the reduction in excess capital adequacy.

A. Credit institutions' total excess capital adequacy and accumulated change in underlying factors



Note: The chart shows the sum of the excess capital adequacy relative to a level of 3 per cent of total assets for Danske Bank, Jyske Bank, Sydbank and Nordea AB. The chart also shows the accumulated change in underlying factors over the period. The estimation of excess capital adequacy is described in detail in Grinderslev, Oliver J. and Kristian L. Kristiansen (2016), Systemic Risk in Danish Banks: Implementing SRISK in a Danish Context, Danmarks Nationalbank, *Working Paper* No. 105. The most recent observations are from 27 May 2016.

Source: Bloomberg, SNL Financials and own calculations.

1. The listed group as a whole is included in the assessment, i.e. also any subsidiaries such as mortgage banks. Likewise, the Swedish Nordea group as a whole is included in the model, not only its Danish subsidiary.

2011 is the result of several factors. One factor is an increase in the book value of the institutions' equity, another that the market perception of the institutions has improved. The most recent fall in excess capital adequacy was driven mainly by declining equity prices and a sharp drop in the market value under stress. This may reflect investors' concerns that banks' earnings potential will weaken in the future. The drivers of developments in credit institutions' excess capital adequacy are described in detail in Box 2.4.

NEW CRISIS MANAGEMENT REGIME PUTS AN END TO THE IMPLIED GOVERNMENT GUARANTEE FOR THE LARGEST CREDIT INSTITUTIONS

During the most recent financial crisis, a number of distressed European credit institutions, their owners and creditors were rescued by means of government funds in a bail-out. The authorities found that intervention was necessary in order to ensure continuation of SIFI functions that are critical to the real economy. On 1 January 2016, the EU implemented the new framework on recovery and resolution of credit institutions, the BRRD, which provides the framework for enabling resolution of any institution, irrespective of its size and functions.[17] The new recovery and resolution framework gives the resolution authorities access to a number of measures and tools enabling resolution of SIFIs rather than bail-out. This represents a fundamental shift to a new regime as regards international regulation of credit institutions.

When all institutions can be resolved, systemic institutions cannot benefit from expectations of a bail-out to avoid default ('too big to fail'). This will promote sound risk management incentives and ensure that owners and investors are more aware of the credit institution's capitalisation and risk exposures. The spread between funding costs for large and small institutions has been reduced relative to previously.

The new rules provide the framework for enabling the restructuring or resolution of any bank without significant adverse impact on the real economy and financial stability and without the use of government funds. This is ensured, inter alia, by writing down or converting the claims of owners and creditors to the extent necessary, i.e. bail-in. A key element of the resolution planning is to set a minimum requirement for the individual SIFIs' eligible liabilities, MREL. The specific MREL must be set to ensure that the institution has sufficient eligible liabilities to absorb losses and to restore its capital if the institution is to return to the market.

Danmarks Nationalbank is contributing to the work of the Danish Financial Supervisory Authority and the Financial Stability Company of drawing up resolution plans for the systemic credit institutions in Denmark to ensure that these are resolvable. Many factors – financial, legal and organisational – affect the resolvability of an institution. Danmarks Nationalbank assesses the resolution planning work as a crucial element in the task of contributing to financial stability, especially in terms of ensuring that Danish SIFIs can be resolved without having an unacceptable detrimental impact on financial stability and the real economy.

NEW GUIDELINES FOR LOAN IMPAIRMENT CHARGES ARE REQUIRED FROM 2018

Confidence in the resilience of credit institutions depends not only on their capitalisation but also on their ability to present true and fair financial statements on an ongoing basis.

Danish accounting rules for financial enterprises are based on the valuation rules of the International Financial Reporting Standards, IFRS. This means that banks that are required to present their consolidated financial statements in accordance with IFRS can use the same valuations in the parent company financial statements and the consolidated financial statements. Experience gained from the financial crisis, including the run-up to the default of Amagerbanken, showed that a more precise framework was needed for the institutions' determination of loan impairment charges than what follows directly from the International Financial Reporting Standards. Against that backdrop, in 2012 the Danish Financial Supervisory Authority, FSA, prepared an annex to the Danish accounting rules (annex 10), establishing guidelines to Danish credit institutions for how to recognise an impairment loss in various types of exposure in the opinion of the Danish FSA. These guidelines were prepared with a view to ensuring that the institutions' accounting policies were still aligned with

17 See the chapter New recovery and resolution regime in Danmarks Nationalbank, *Financial stability*, 2nd Half 2015.

the International Financial Reporting Standards, while the scope for management judgement was narrowed. In 2014, this annex was supplemented by guidelines that elaborate on the Danish Financial Supervisory Authority's practice in this area.

The European Commission is expected to endorse IFRS 9 in the 2nd half of 2016. This standard incorporates, inter alia, a new loan valuation model. Under this model, an institution must estimate and recognise an expected credit loss on an ongoing basis – and already from the time the loan is granted. The expected credit loss is estimated based on two parameters: probability of default and loss given default. For loans, the credit risk of which is not assessed to have increased significantly, the expected loss must be based on the probability of default within the next 12 months. For loans, the credit risk of which is assessed to have increased significantly and is not assessed to be low, the expected loss must be based on the probability of default over the remaining life of the loan.[18]

In Danmarks Nationalbank's assessment, the guidelines in the current annex 10 – along with efficient enforcement in connection with the Danish Financial Supervisory Authority's ongoing inspections – have helped to increase comparability across the loan impairment charges of the individual credit institutions. The Danish Financial Supervisory Authority's asset quality review ahead of the pan-European stress test in 2014 showed that the need for value adjustments in Danish institutions was modest compared with that of other countries, which could be seen as an indication that the guidelines have been useful. Although the new loan valuation model in IFRS 9 is based to a higher degree on the use of statistical parameters (bearing some resemblance to the parameters known from the internal models of major banks), the determination of loan impairment charges will still be based on the bank making a number of significant estimates and assessments. Therefore, there may still be a need for the Danish Financial Supervisory Authority to establish detailed guidelines to support the application of the rules of the international accounting standards in practice.

In principle, IFRS 9 will come into effect on 1 January 2018. It is important that credit institutions prepare for timely implementation of the new rules. Thus, it would be appropriate for the Danish Financial Supervisory Authority, in parallel with the EU endorsement process, to present a draft for a new set of detailed guidelines to give the institutions the best possible basis for the implementation of IFRS 9. The guidelines should still be based on the International Financial Reporting Standards, including the neutrality principle, but should also ensure that the institutions exercise a reasonable degree of prudence when making accounting estimates. That way, the guidelines may help to ensure uniform practice across institutions and promote a high degree of credibility in their financial reporting.

FINANCIAL MARKET LIQUIDITY AND MARKET PARTICIPANT RESILIENCE

CREDIT INSTITUTIONS HAVE ROBUST LIQUIDITY RESERVES

The liquidity coverage ratio, LCR, of all credit institutions is comfortably above the statutory minimum requirements, cf. chart 2.24. The LCR is a short-term liquidity requirement, which is to ensure that the institutions always have adequate high-quality liquid assets to cover an outflow of liquidity in an intensive 30-day stress scenario.

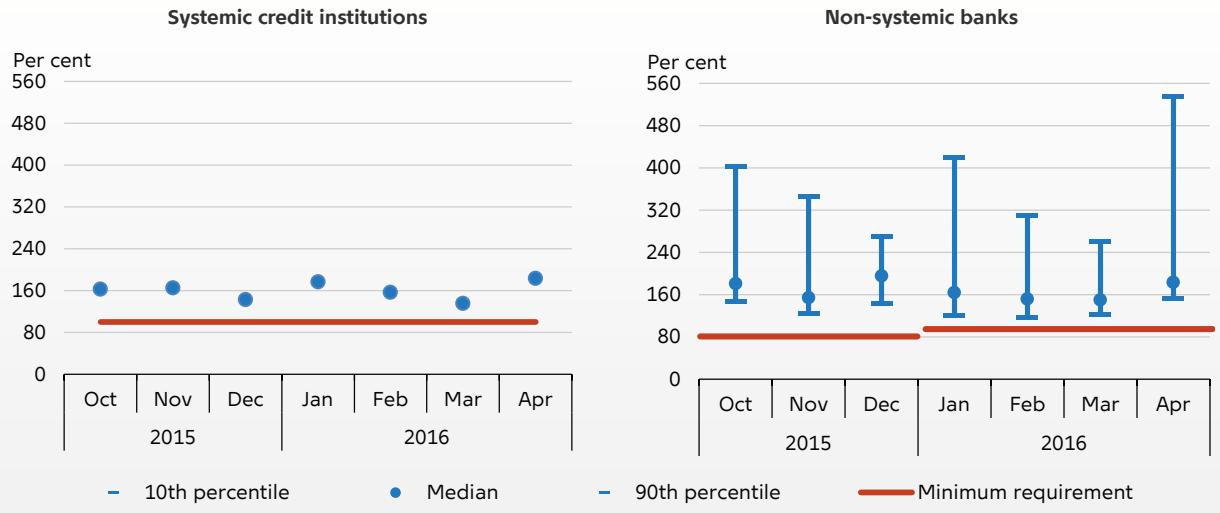
The systemic credit institutions must comply with a minimum LCR requirement of 100 per cent, while the non-systemic banks must comply with an LCR requirement of 70 per cent in 2016. The minimum requirement for the non-systemic banks will be tightened to 80 per cent in 2017 and 100 per cent by 2018.

There are considerable variations between the LCRs of the institutions, and levels may fluctuate greatly from one month to the next. The business models of some banks ensure a generally high LCR, while others need to take a more active approach in monitoring their liquidity reserves. Given that the LCR can be a volatile measure, it is appropriate for the institutions to aim for some excess cover relative to the minimum requirements.

The LCR requirement must be complied with for all currencies together. It is important, however, that the institutions' foreign exchange liquidity risk management is adequate and that they have a sufficiently robust business model to counter a stress

18 The impairment model of IFRS 9 is described in in more detail in Box 2.4 in *Financial stability*, 2nd Half 2014.

Liquidity Coverage Ratio, LCR Chart 2.24



Note: The red lines indicate the minimum LCR requirements. The requirement for the systemic credit institutions is a minimum of 100 per cent from October 2015. The requirement for the non-systemic banks was a minimum of 60 per cent in 2015, rising to 70 per cent in 2016. The requirement will increase to 100 per cent by 2018. The most recent observations are from April 2016.
Source: Danish Financial Supervisory Authority and own calculations.

scenario of foreign exchange liquidity outflow. Consequently, it is important that the credit institutions' business models are not based on access to foreign exchange from central banks. The financial crisis showed that moving from one currency to the next in the market can be difficult. Accordingly, credit institutions should build up a portfolio of high-quality liquid foreign exchange assets to ensure that they have access to liquidity in the significant currencies in which they have outflow of liquidity. A portfolio of high-quality liquid foreign exchange assets to counter a stress scenario of liquidity outflow in the currency concerned will support financial stability and reduce the likelihood that central banks must provide emergency liquidity in foreign exchange as seen during the financial crisis.

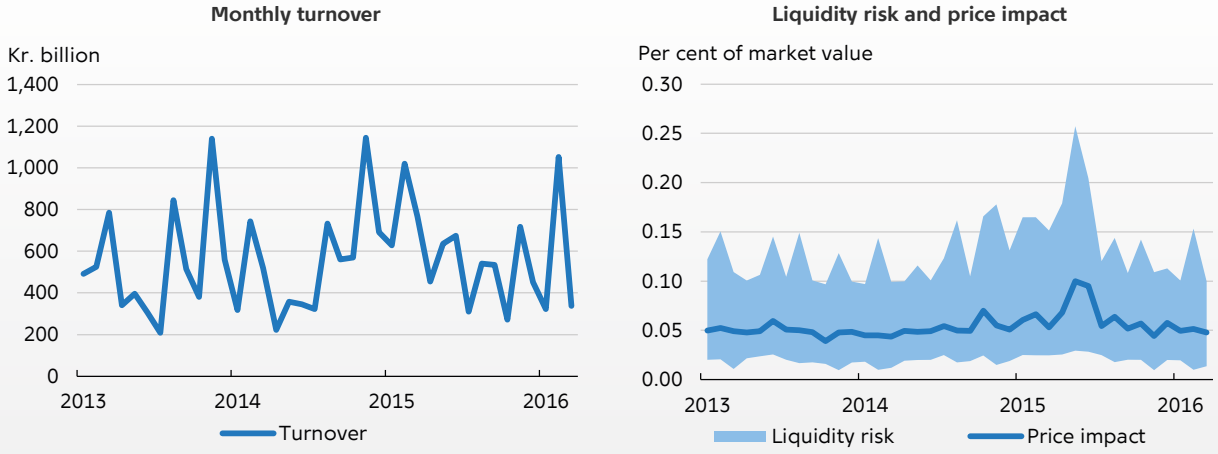
CONTINUED HIGH TURNOVER IN THE MORTGAGE BOND MARKET

In the 1st quarter of 2016, turnover in the market for mortgage bonds matched that of recent years, cf. chart 2.25 (left), and the price impact of transactions in the market is still limited, cf. chart 2.25 (right). The price impact of a transaction is estimated by the difference between the latest traded price before a transaction to the traded price of the transaction. The dispersion in the price impact across transactions, the liquidity risk, was increasing from the end of 2014 until mid-2015, but since then it has fallen back. Mortgage bonds are a key asset type in the Danish financial system. They are used, inter alia, by banks in their liquidity management and by pension companies in their management of household pension wealth.[19]

Mortgage bonds are usually traded through a bank that intermediates between the seller and the buyer. Danish banks have stabilised their portfolios of mortgage bonds for market making since November 2015, after reducing the portfolios from mid-2014, cf. chart 2.26 (left). Relative to February 2015, systemic credit institutions have especially reduced their portfolios of mortgage bonds issued by their affiliated mortgage banks, cf. chart 2.26 (right). This should be seen in light of the fact that own bonds cannot be included as LCR liquid assets. During the same period, Danish insurance companies and pension funds as well as non-resident investors, including the hedge funds

19 See a detailed analysis of liquidity in the mortgage bond market in Danmarks Nationalbank, *Financial stability*, 2nd Half 2015.

Turnover and liquidity risk in the mortgage bond market Chart 2.25

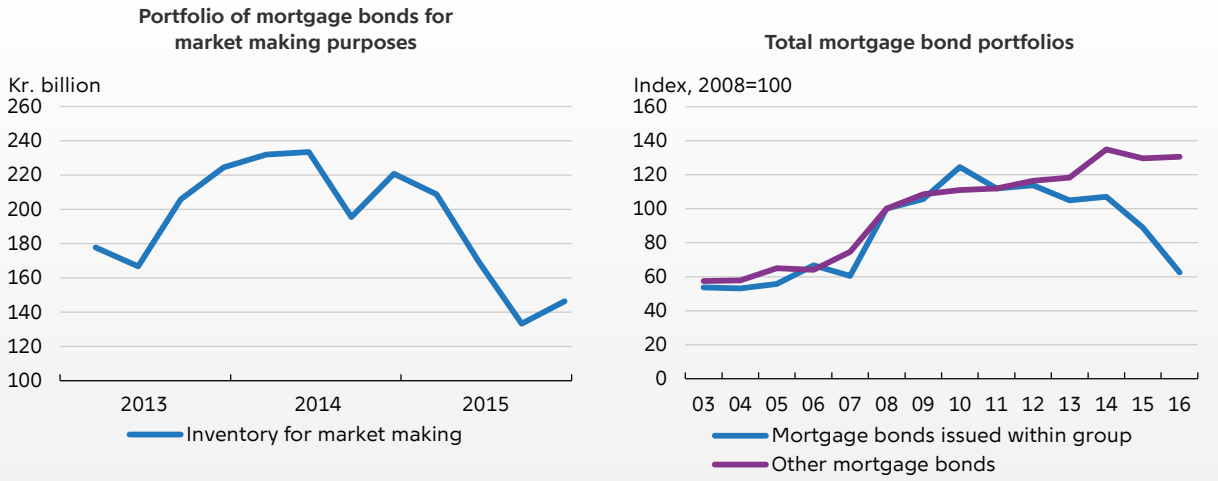


Note: In the right-hand chart, the price impact is given by the monthly median of price impacts for transactions across all bond series. Liquidity risk is calculated as the difference between the 75th percentile and the 25th percentile of the price impact. The most recent observations are from March 2016.
Source: Danmarks Nationalbank, MiFID transaction reports and own calculations.

of Danish investors abroad, have increased their holdings of mortgage bonds.

Market participants point out that, in recent years, market makers have become less willing to absorb imbalances between buyers and sellers of mortgage bonds. This has happened against the backdrop of declining risk appetite in the financial sector since the financial crisis. For example, new regulation in the form of enhanced capital and liquidity requirements has impacted banks' risk-taking. On the one hand, this regulation has ensured that banks have become more resilient than

Systemic credit institutions' mortgage bond portfolios Chart 2.26

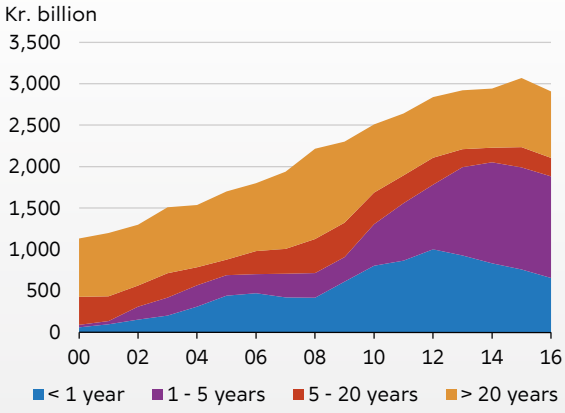


Note: The left-hand chart shows net holdings at market value in Danish kroner, i.e. the total value of long positions less the value of short positions. Mortgage bonds held for repo transactions are not included. The chart is based on a survey conducted among the five largest credit institutions. The most recent observations are from March 2016. The right-hand chart is based on a total holding of mortgage bonds for all purposes. Mortgage bonds held for repo transactions are not included. Observations show holdings at the end of March each year.
Source: Danmarks Nationalbank, Danske Bank, Jyske Bank, Nordea Bank Danmark, Nykredit Bank, Sydbank and own calculations.

previously. On the other, lower risk appetite and new regulatory requirements may have reduced banks' market making activities. Smaller portfolios of mortgage bonds for market making may entail that the market becomes more order-driven in future, with banks increasingly not engaging in market marking activities until both the seller and the end-investor have been found.

Mortgage banks are entering into agreements under which several of the major banks commit to quoting two-way prices for mortgage bonds against payment of a fee. These agreements are part of the adjustment to the best execution rules of the upcoming MiFID II Directive[20] and will also support liquidity in the series in question.

Remaining maturity of outstanding volume of mortgage bonds Chart 2.27



Note: The chart shows the outstanding volume at the end of March each year.
Source: Danmarks Nationalbank.

MORTGAGE BANKS REDUCE THE NUMBER OF SMALL BOND SERIES

Mortgage banks are striving to reduce the number of small, low-liquidity bond series. Fewer small series may contribute to higher and more robust liquidity in the market for mortgage bonds.

The mortgage bond market consists of a large number of series, but the outstanding volume is primarily concentrated in a few large series. Mortgage bonds from small series are traded at a higher yield than large series to compensate for lower liquidity. Mortgage banks pass on the cost of bond yield payments directly to the borrower. Higher bond liquidity may therefore benefit mortgage bank customers through lower interest rates.

To be able to continue to ensure high liquidity in the mortgage bonds issued and comply with the LCR requirements for highly liquid bonds, BRFkredit, Nykredit and Totalkredit took steps to reduce the number of ISIN codes and thus increase the outstanding amount in each series earlier this year. Inter alia, they reduced the number of annual refinancing auctions for short-term fixed bullets from four to two, or one in the case of BRFkredit.

Mortgage banks must still ensure that they assume limited refinancing risk through the issuance of long-term mortgage loans financed by short-term bonds. The refinancing risk of each auction can be lowered either by reducing issuances of short-term fixed bullets or by spreading the refinancing over several auctions. Since the outstanding volume of one-year bonds with annual refinancing has decreased since 2012, cf. chart 2.27, the need to spread the refinancing over several auctions has been reduced.

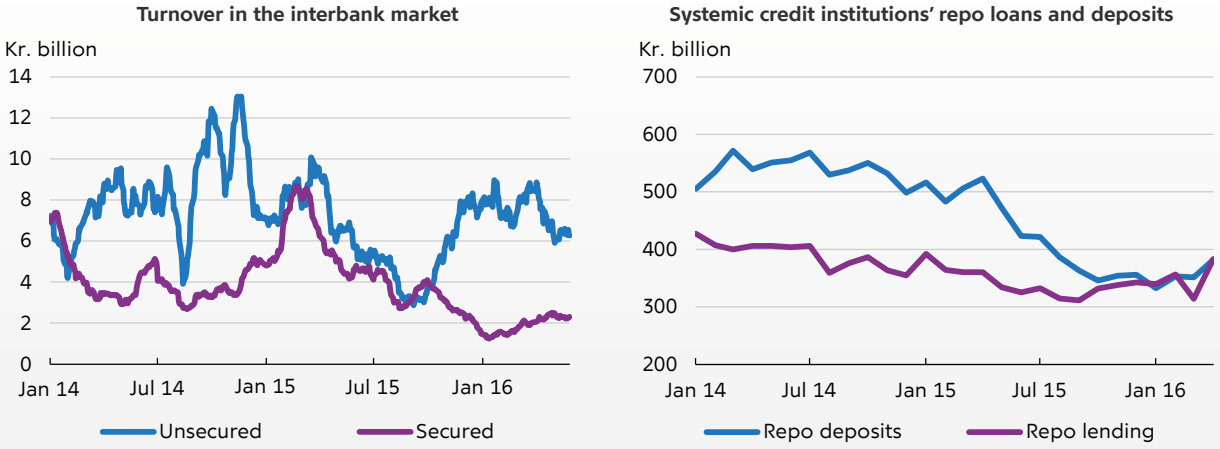
The Supervisory Diamond for mortgage banks includes an indicator according to which the percentage of loans to be refinanced within any quarter must be less than 12.5 per cent of total loans. The Supervisory Diamond indicators set limits on mortgage banks' risk-taking and are to serve as early indicators if a mortgage bank is starting to take on too much risk.

If the outstanding volume of short-term fixed bullets were to increase in future, it could be necessary for mortgage banks to spread their refinancing auctions over several annual auctions to comply with the Supervisory Diamond requirements.

In March 2016, BRFkredit issued mortgage bonds denominated in euro with an original maturity of five years. The reason for this was a wish to achieve lower yields on the bonds issued as a result of larger series and a larger investor base in the euro market. The bonds finance the home purchase loans in Danish kroner with an adjustable-rate period of less than five years of the parent company, Jyske Bank. Under the new funding model, the institution subsequently hedges the exchange rate risk and differences in the cash

20 See Directive 2014/65/EU of the European Parliament and of the Council on markets in financial instruments.

Turnover in the interbank market and systemic credit institutions' repo loans and deposits Chart 2.28



Note: The left-hand chart shows the turnover of the current eight reporters of Tomorrow-Next (T/N) for the entire period, aggregated across reporters and maturities. 21-day moving average of daily observations. The most recent observations are from 28 May 2016. In the right-hand chart, the average monthly volume of repo loans and deposits covers repo/reverse transactions and securities lending and deposits, etc. Intra-group transactions and transactions of the foreign units of Danish institutions have been excluded. The most recent observations are from the end of April 2016.
Source: Danmarks Nationalbank and own calculations.

flows of the bond and the home loans using financial derivatives. Hedging of differences in the cash flows of loans to home buyers and the underlying bonds ensures that the model complies with the general balance principle, introduced in 2007 with legislation on covered bonds (SDOs) and covered mortgage bonds (SDROs).

INTERBANK MARKET ACTIVITY HAS BEEN STABLE

Credit institutions use the interbank market to exchange liquidity through both collateralised and uncollateralised loan agreements. In the collateralised interbank market, credit institutions provide interbank loans against securities in repo loans and deposits as collateral. Banks' market making activities in the mortgage market depend on their access to credit and hedging facilities e.g. in the repo market.

After falling in recent years, turnover in the repo market has been stable at the beginning of 2016, cf. chart 2.28 (left). Lower activity in the market may reflect that credit institutions have reduced their repo deposits, cf. chart 2.28 (right). Overall, the institutions no longer use the repo market for funding, and their net exposure is close to zero.

Less willingness to maintain substantial financial market trading activities and tighter capital and liquidity coverage requirements for credit institutions have raised the costs of repo transactions. This may have reduced the incentive of credit institutions to participate in activities in the collateralised interbank market.[21]

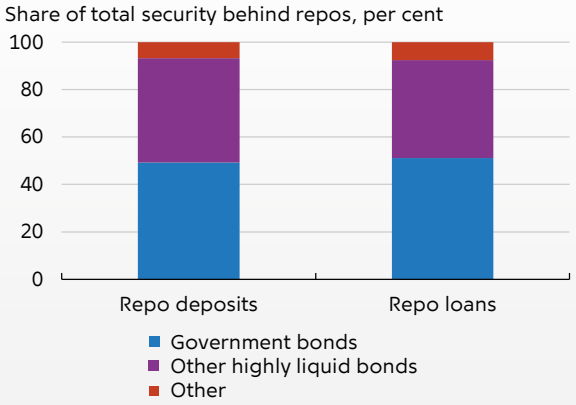
In the collateralised interbank market, high ratings of securities offered for collateral are essential to resilient market liquidity. Systemic credit institutions' repo transactions are generally collateralised against government bonds and other highly liquid bonds with high credit ratings, cf. chart 2.29.[22] High ratings of collateral and generally higher liquidity and capital coverage of banks contribute positively to repo market liquidity.

21 See Danmarks Nationalbank, *Financial stability*, 2015.

22 The "Other highly liquid bonds" category is covered bonds with a rating of at least AA and an issued volume of at least 500 million euro. In Denmark, about 80 per cent of the total volume of mortgage bonds issued belong in this category, see Danmarks Nationalbank, *Financial stability*, 2nd Half 2015.

Collateral underlying systemic credit institutions' repo transactions, April 2016

Chart 2.29



Note: Collateral against own bonds issued by the institutions within the group are not included in the calculation as highly liquid bonds, even if this is the case. The reason is that holdings of own bonds cannot be included as LCR liquid assets.

Source: Danish Financial Supervisory Authority and own calculations.

3

THE COST OF EQUITY

INTRODUCTION AND SUMMARY

Several credit institutions target an annual return of up to 12.5 per cent on the book value of equity.

Given the very low level of interest rates, the targets set by these institutions for return on equity, ROE, appear high. According to these targets, the institutions should yield a considerable excess return relative to an investment in a Danish government bond, which is regarded as (almost) risk-free. In order to achieve this excess return, the institutions can cut costs and streamline operations, but this is possible only to a certain extent. Alternatively, they can charge high prices for their services, which requires lack of competition. If it is not possible to boost ROE in these ways, it may be necessary for the institutions to increase their risk. They can do so via more risky lending, which will increase earnings if all goes well, but it will also increase the risk of losses. Finally, the institutions can increase their ROE by increasing their leverage ratios, i.e. their exposures relative to equity, e.g. by distributing higher dividends or conducting share buy-backs. This will increase earnings per krone of equity, but at the same time the institutions' capitalisation will deteriorate, thereby making them more risky.

Hence, Danmarks Nationalbank finds it natural that the credit institutions consider whether their ROE targets are fully consistent with a prudent level of risk.

An institution can finance its assets via equity or loans, i.e. debt. The cost of holding debt is the interest paid. Equity is often share capital, for which the cost is the shareholders' required return when buying or holding on to their shares.

Whereas the interest paid on debt is directly observable, shareholders' required ROE cannot be observed. Instead, shareholders' implied required return can be estimated using e.g. share prices and analysts' expectations of the future profits of credit institutions.

This chapter estimates that shareholders' implied required return is currently around 8 per cent of the *market value of equity* for the largest credit institutions in Denmark. This is relatively low compared with recent years and to a large extent reflects a decline in the risk-free interest rate to a level close to zero. Furthermore, shareholders have reduced their risk premium requirements when buying Danish bank shares. This should be viewed in the light of factors such as the institutions' increased capitalisation and collateral requirements in recent years, as well as their improved liquidity reserves.

In their financial statements, the credit institutions state their ROE, i.e. profits relative to the *book value of equity*. The book value is calculated for accounting purposes and is independent of fluctuations in share prices. Consequently, the market and book values of equity differ, as do the shareholders' required rate of return on the *market value of equity* and their expected rate of return on the *book value*, assessed on the basis of the prices at which the shares are traded.

In 2015, the return on the book value of equity ranged from approximately 8 to 12 per cent for the four largest credit institutions in Denmark.[1] These

1 Danske Bank A/S, Nordea Bank AB, Jyske Bank A/S and Sydbank A/S.

levels should be compared with the shareholders' expected rates of return on the *book value of equity*, which ranged from 5 to 11 per cent in 2015 according to the calculations in this chapter. So the institutions delivered a higher return on the book value of equity than expected by the shareholders.

MORE EQUITY REDUCES THE PRICE OF BOTH EQUITY AND DEBT

Credit institutions are often hesitant to increase their equity-to-debt ratio, in many cases citing that the cost of a given volume of equity is higher than the cost of a similar volume of debt.

However, this is an all-else-equal view that does not take into account the institutions' overall funding costs, i.e. the costs for both equity and debt.

On the one hand, more equity and correspondingly lower debt will increase the funding costs, as the risk premium is higher for equity, which is first to absorb any losses. On the other hand, more equity will reduce the risk of incurring losses on debt. Furthermore, a smaller share of the equity is required to cover a given loss, i.e. the risk of loss per krone of equity decreases. This leads to lower risk premia on both equity and debt.

UNDER CERTAIN ASSUMPTIONS, FUNDING COSTS ARE INDEPENDENT OF THE EQUITY-TO-DEBT RATIO

Under certain assumptions, the ratio of equity to debt has no impact on an institution's funding costs.[2] This applies if factors such as taxes, asymmetric information and default-related costs are disregarded, while it is assumed that the markets are efficient and that it is cost-free to raise new capital. The risks and return on the institution's assets are the same irrespective of the method of funding. Consequently, the total funding costs for the institution's debt and equity are not affected by the equity-to-debt ratio. This means that the institution can increase its equity relative to debt – and hence its robustness – without increasing its funding costs.

However, in practice there are circumstances that favour debt over equity.

The tax system favours debt

Firms may deduct interest expenses on their tax returns, but not dividend payments to owners. So a high leverage ratio can reduce total tax payments, and viewed in isolation this boosts profits after tax. In other words, the tax system favours debt over equity.

For example, at the current rate of corporate tax, the tax deductibility of interest reduces the cost of debt by 0.22 percentage point for every per cent payable in interest on the debt.

Furthermore, shareholders and creditors are taxed on dividend and interest income, respectively. The percentage depends on several factors, including investor type and income, but in general this reduces the difference for the final investor.[3]

A better capitalised banking sector reduces payments to the deposit guarantee scheme

The deposit guarantee scheme is another arrangement that favours debt over equity. A large part of the banks' deposits is covered by the deposit guarantee scheme, i.e. depositors will not suffer losses on these deposits, irrespective of any resolution of the bank. Hence, the rate of interest on these deposits and the banks' costs on this part of their debt are independent of how well-capitalised and thus safe the banks are.

In Denmark, the deposit guarantee scheme is financed via contributions from the Danish financial enterprises whose deposits are covered. These contributions are independent of the institutions' credit risks. If an institution becomes subject to resolution proceedings, the remaining institutions must top up the assets of the deposit guarantee scheme once it has met the losses on the deposits covered.

If the entire sector becomes better capitalised, e.g. due to regulatory requirements, fewer institu-

2 See Franco Modigliani and Merton H. Miller (1958), "The Cost of Capital, Corporation Finance and the Theory of Investment", *The American Economic Review*, Vol. 48, No. 3, June, pp. 261-297.

3 The advantage of debt financing is given by the interest income from debt after capital income tax less dividend payments after equity income tax and corporate tax, i.e. (1-capital income tax rate)-(1-equity income tax rate)*(1-corporate tax rate). For e.g. a Danish pension fund, the tax rate is 15.3 per cent for both equity and capital income, while a private investor paying the top marginal tax on both equity and capital income is subject to a tax rate of 42 per cent for both income types.

tions will be subject to resolution, and the deposit guarantee scheme will be used less frequently. As a result, the institutions will need to cover fewer losses, which will reduce their costs for the deposit guarantee scheme. So the gain from a generally better capitalised banking sector will be reaped by the banks.

For the individual institution there is no incentive to increase capitalisation, however. This is because the costs are higher for equity than for debt and the individual bank's payments to the deposit guarantee scheme are determined by the capitalisation of the other banks.

New recovery and resolution regime reduces the advantages of holding debt over equity

Expectations of an implied government guarantee have often been mentioned as a factor that could cause total funding costs to rise when a credit institution becomes better capitalised. The reason given has been that the costs to society are so large if a credit institution defaults that the government will find it most expedient to prevent a default by transferring funds to the institution. If the institution increases its equity, the risk of default, and hence the probability of a transfer of funds from the government, decreases, thereby reducing the value of the implied government guarantee.

The new European Bank Recovery and Resolution Directive, BRRD, gives the resolution authorities a toolbox for resolution of any institution, irrespective of its size and functions. This should eliminate expectations of an implied government guarantee, which can then no longer be expected to have any impact on an institution's funding costs.

Structural conditions favour debt only to a modest extent

All in all, the above factors, which favour debt over equity, seem to have a limited effect on the credit institutions' aggregate funding costs. Furthermore, a rise in the institutions' funding costs does not reflect higher costs to society, but rather a redistribution from the institutions to the central government or the deposit guarantee scheme – and savings by the latter accrue to the institutions themselves.

But the total funding costs of the institutions may temporarily rise a little following an increase in the equity-to-debt ratio. This is because all debt has not yet been refinanced. Therefore part of the debt is at a higher rate of interest, which is determined by, inter alia, the risk premium before the equity increased and the debt became safer. Until all debt has been refinanced, the creditors, not the institution, profit from the institution's improved capitalisation.

Market data shows that the cost of improved capitalisation for credit institutions is modest

The better capitalised the credit institutions are, the less investors will require in return on both equity and debt. That is demonstrated by market data from late 2015 for a number of large European credit institutions. It is seen that the higher the market-based equity ratio is, i.e. investors' assessment of the market value of equity relative to liabilities, the lower the investors' required rate of return will be for both senior debt and equity, cf. Chart 3.1.

The funding costs for various ratios between debt and equity can be calculated by comparing the implied rate of return required for senior debt and equity at different equity ratios. The weighted average cost of capital, WACC, can be calculated as

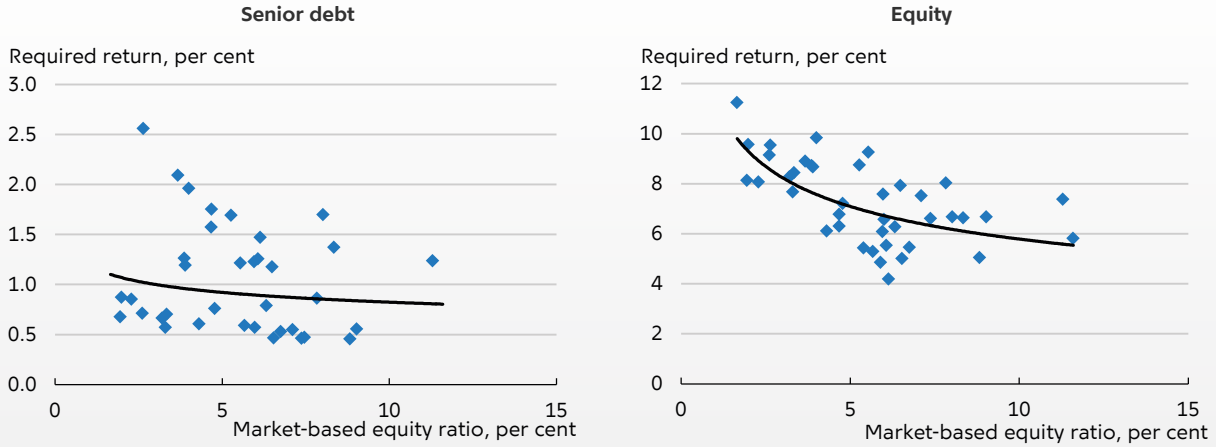
$$WACC = r_E \frac{E}{D+E} + r_D \frac{D}{D+E} \quad (1)$$

where r_E and r_D are the estimated rates of return required by investors on equity and debt, respectively, E is the market value of equity and D is the book value of debt.

According to market data, the WACC rises by between 0.01 and 0.05 percentage point for each percentage point increase in the equity ratio, cf. Chart 3.2. The increase is of the same magnitude irrespective of whether the data reviewed is from 2008, i.e. during the financial crisis, or later, although there are considerable differences in the level of the risk-free interest rate and the institutions' equity relative to debt.

This indicates that the cost of improved capitalisation for the institutions is modest. Moreover, there is a gain for others than the institutions, e.g. because better capitalised institutions reduce the risk of a financial crisis.

Investors' implied required returns for large European credit institutions, end-2015 Chart 3.1



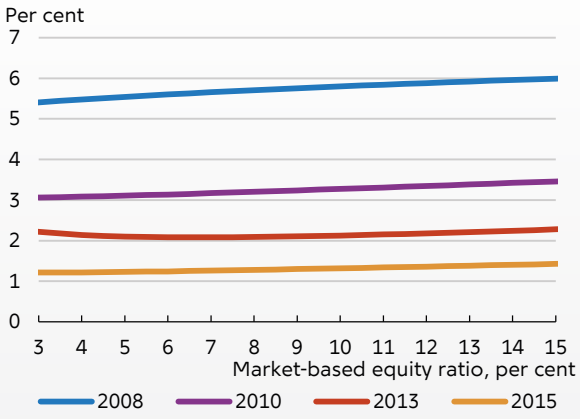
Note: The market-based equity ratio is the market's assessment of the value of equity relative to the value of liabilities. Left-hand chart: The required returns on senior debt have been calculated on the basis of CDS spreads. Right-hand chart: The required returns on equity have been calculated on the basis of a Dividend Discount Model and an adjusted CAPM, cf. Box 3.1.
Source: Bloomberg, Thomson Reuters Datastream, Consensus Economics and own calculations

COST OF EQUITY FOR CREDIT INSTITUTIONS

The cost of equity for a credit institution is given by shareholders' required rate of return on the market value of equity, i.e. the return on investment required by shareholders if they are to buy or hold on to their shares. Shareholders' required return is the sum of the risk-free interest rate and the risk premium required for investing in the shares.

The required rate of return cannot be observed directly, one reason being that the shareholders' risk premia are not known. The required rate of return must therefore be estimated, resulting in an implied required return. In this analysis, that is done by means of a Dividend Discount Model, which utilises the fact that share prices, risk-free interest rates and analysts' expectations of firm earnings are known back in time. This means that the risk premium and required rate of return can be determined, albeit with some uncertainty, cf. Box 3.1.

Weighted average cost of capital in large European credit institutions Chart 3.2



Note: 4th-quarter averages for the years shown. The market-based equity ratio is the market's assessment of the value of equity relative to the value of liabilities. The calculations do not take the tax systems and deposit guarantee schemes of the respective countries into account. In Denmark, the deposit guarantee scheme is funded by the financial sector. If the whole sector becomes better capitalised, the gain in terms of the assets of the deposit guarantee scheme will be reaped by the institutions themselves.
Source: Bloomberg, Thomson Reuters Datastream, Consensus Economics and own calculations.

The required rate of return varies over time

The required rates of return for the largest listed credit institutions in Denmark have been estimated since 2003, cf. Chart 3.3. It is seen that the implied required returns vary considerably over time, and that in recent years they have fallen to between 5 and 10 per cent, from a level of around 10 and 20 per cent during the financial crisis in 2008-09.

Model for determining shareholders' required return

The cost of equity for a listed credit institution is given by shareholders' required return on the institution's shares. The latter depends on the risk-free interest rate and the risk premium required by shareholders as compensation for owning shares that entail a risk of losses. However, the risk premium cannot be observed directly, which leads to uncertainty about shareholders' required return and hence the cost of equity.

Since the required return cannot be observed directly, it must be estimated on the basis of share prices. This means that it will reflect the actual rate of shareholders' required return when they buy and sell the shares, not what they might say if simply asked.

The required return can be estimated in several ways. This box applies methods that are well-described in the literature and based on publicly available data. Consequently, the results can be replicated and the assumptions changed.

The estimation of shareholders' required return is based on two steps. First, the shareholders' implied required return for a broad-based European stock index (the market portfolio) is estimated. Then, the required return on specific bank shares is found using a Capital Asset Pricing Model, CAPM.

Shareholders' implied required return for a broad-based European stock index

The shareholders' implied required return for the European stock market is based on a Dividend Discount Model.[1] According to the model, the share price is determined as the present value of all expected future payments, i.e. the expected payments discounted by the required rate of return, which is the sum of the risk-free interest rate and the risk premium. The model is constructed as follows

$$P_t = \underbrace{\sum_{i=1}^{A} \frac{D_{t+i-2}\left(1+g^a\right)}{\left(1+rf_{i,t}+rp_t\right)^i}}_{\text{Short term}} + \underbrace{\sum_{i=A+1}^{B} \frac{D_{t+i-2}\left(1+\left(g^a-\left(g^a-g^l\right)\frac{i-A}{B-A}\right)\right)}{\left(1+rf_{i,t}+rp_t\right)^i}}_{\text{Medium term}} + \underbrace{\frac{D_B\left(1+g^l\right)}{\left(1+rf_{30,t}+rp_t\right)^B\left(rf_{30,t}+rp_t-g^l\right)}}_{\text{Long term}}$$

where P is the share price, D is disbursements (dividends and buy-backs), rf is the risk-free interest rate, rp is the risk premium, while g^a and g^l are growth in disbursements in the short and long term, respectively, expected at time t.

So the share price is determined by shareholders' required return and expectations of future disbursements (the numerators in the above equation), which grow at different paces over time:

- Short term: Disbursements grow by g^a until and including period A, which has been set at three years. During this period, the enterprise is expected to see growth in disbursements that differs significantly from the general, long-term economic growth rate. This can be attributable to e.g. expansion of business areas, streamlining, favourable sales opportunities, etc.
- Medium term: Growth in disbursements gradually changes from g^a to g^l during this transitional period. B has been set at seven years here, i.e. this period is three to seven years into the future.
- Long term: After period B, disbursements grow at a constant rate of g^l, which is the long-term economic growth rate in the economy. This means that the enterprise cannot grow infinitely large or vanish completely.

The risk premium can be estimated if the share price and the shareholders' expectations of future dividends as well as the risk-free interest rate are known. Since the price of a share is given by the shareholders' expected future payments from the share, i.e. including the risk of losses, the estimated risk premium will reflect the compensation required by the shareholders for taking on the expected risk.

Share prices, the risk-free interest rate (swap rate) and disbursements in the form of dividends and buy-backs can all be observed, while expected growth in disbursements in the short and long term is based on analysts' expectations.

As regards short-term growth in disbursements, g^a, it is assumed that it reflects growth in profits, as approximately the same percentage of the profits is disbursed over time if the portfolio is well-diversified. This means that shareholders' expectations of growth in profits can be applied as an estimate of growth in disbursements. Shareholders' expectations of earnings growth are based on the European stock index Euro Stoxx 600, approximated by analysts' expectations at the time in question, i.e. in real time, from Thomson Reuters Datastream.

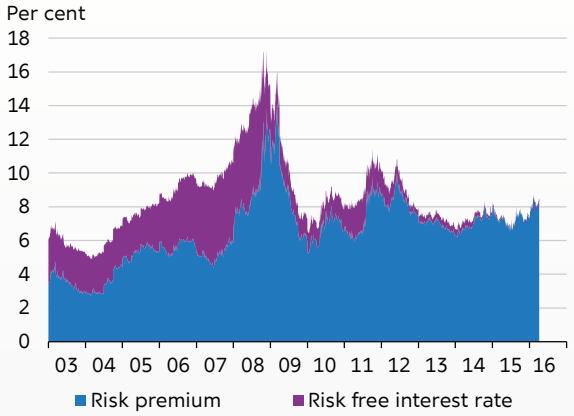
Long-term growth, g^l, is assumed to be the growth in GDP. In this case, analysts' expectations collected by Consensus Economics are applied.

This makes it possible to calculate the required rate of return in the stock market overall, and it is possible to break it down by risk premium, rp_t, and risk-free interest rate, rf_t, cf. Chart A.

1. See e.g. Russel J. Fuller and Chi-Cheng Hsia (1984), "A simplified Common Stock Valuation Model", *Financial Analysts Journal*.

Continued

Chart A: Estimated European required return broken down by risk-free interest rate and risk premium



Note: Required return for Euro Stoxx 600. The risk-free interest rate is given by a 1-year swap rate.
Source: Bloomberg, Thomson Reuters Datastream, Consensus Economics and own calculations.

Shareholders' required return on individual bank shares

The general rate of return required by shareholders in the European stock market is used to determine the required returns on the shares of individual institutions. If a bank share is more risky than the market overall, shareholders will require a higher-than-average return on this share.

The classical Capital Asset Pricing Model, CAPM, says that the risk premium on a share depends on its systematic risk. This is a risk that cannot be diversified away via the market, and hence shareholders require compensation in the form of a risk premium. If the price of a share covaries strongly with the stock market overall, i.e. prices in the market overall and the share in question fall and rise at the same time, the systematic risk is high.

Assuming that the only relevant factor for a shareholder is the non-diversifiable risk, the product of the covariation and risk premium for the market is a measure of the risk premium on the individual share. The covariation is measured by a "beta" calculated on the basis of volatility and the correlation between the market and the share. Since both volatility and the correlation change over time, a dynamic beta based on a Dynamic Conditional Correlation Model is applied.[2] This ensures an up-to-date risk relative to the market. Beta is calculated on the basis of daily share returns and is subject to some volatility. Hence, beta is smoothed using an exponential filter, which ensures that the most recent observations are given the largest weights.

The risk premium on the individual bank share is determined using an adjusted CAPM. This is because historical returns show that the CAPM predicts too large a fall in the return when a share becomes safer. The adjusted CAPM takes this into account so that relative to the classical CAPM it becomes more expensive for the institution to be safer. The adjustment is made by adding an extra term, $\gamma(1-\beta_{i,t})$, to the classical CAPM. The constant determines the size of the adjustment and has been estimated at 0.53 per cent using monthly returns for the large European credit institutions for the period 1999-2015.[3] Thus, the risk premium on the individual bank share, $rp_{i,t}$, is given by

$$rp_{i,t} = \gamma \times (1-\beta_{i,t}) + \beta_{i,t} \times rp_{t},$$

where $\beta_{i,t}$ is the covariation between the share and the market, in this case measured by the Euro Stoxx 600, and rp_t is the market premium. If beta is greater than one, this means that when stock market prices rise, the price of the bank share rises more strongly, and when stock market prices fall, the price of the bank share falls more sharply. Hence, the share is more risky than the stock market as a whole and the risk premium higher. Conversely, the share is less risky and its risk premium therefore lower than the market risk premium if beta is lower than one.

In this model, shareholders' implied required return on a specific bank share is given by the sum of the risk-free interest rate and the estimated risk premium.

This method estimates the rates of return currently required

The method described is based on the definition of shareholders' required return, cf. the first equation above. The implied required returns are forward-looking, i.e. they are based on shareholders' expectations of dividends disbursed by the institution discounted by their required rate of return at the given time. The estimated implied required returns are therefore a better estimate of the current situation than historical estimates are.

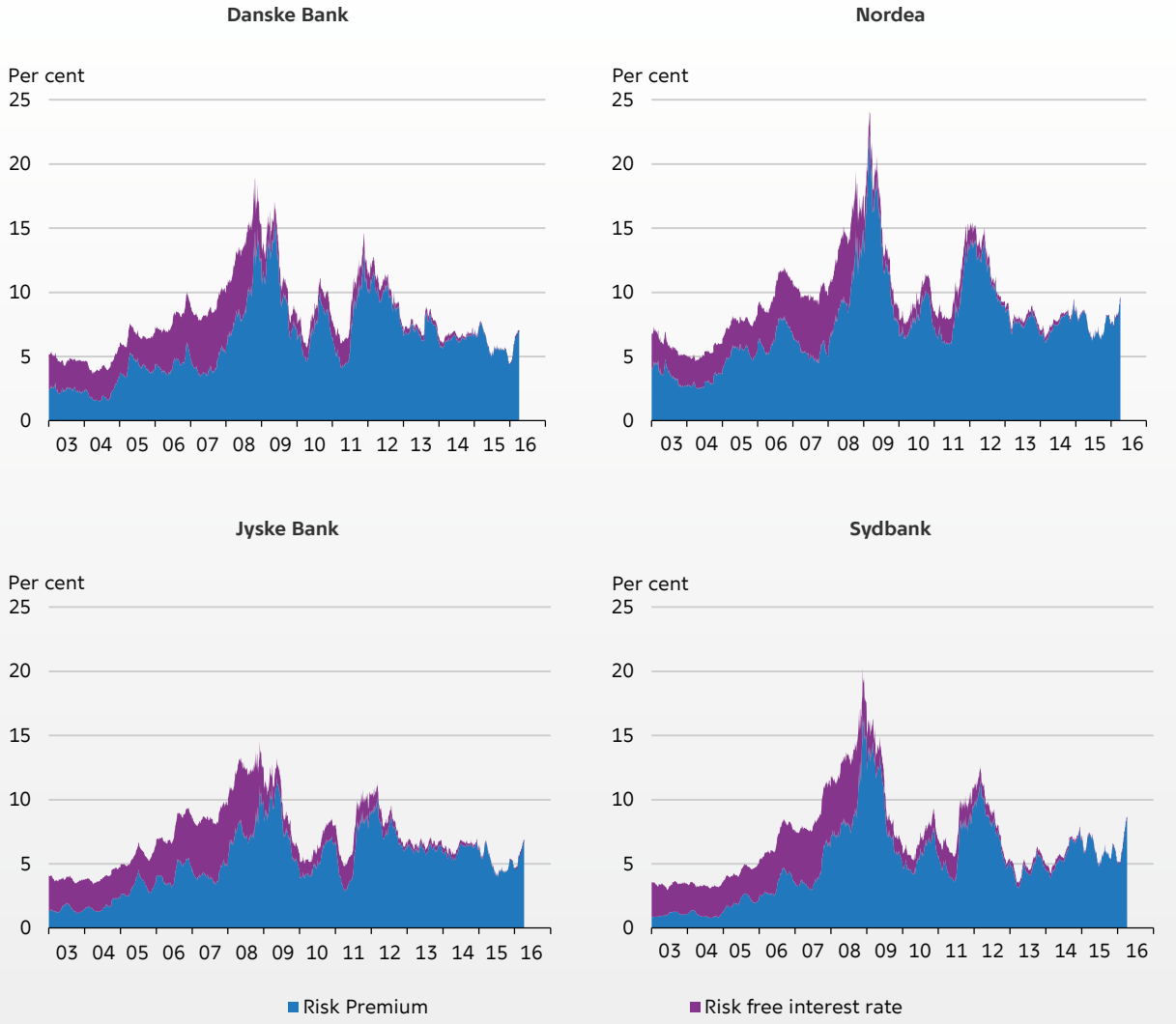
Using this method, it is found that the level of the market risk premium is currently approximately 7-8 per cent, which is somewhat higher than the historical 5 per cent often applied. Furthermore, a relatively conservative approach is taken to the bank-specific required rates of return as the method for transferring the market risk premium to the individual bank shares makes it more expensive to be safer relative to the results of a classical CAPM.

2. See Robert Engle (2009), Anticipating correlations: A new paradigm for risk management, Princeton University Press.

3. The adjustment is based on Malcolm Baker and Jeffrey Wurgler (2015), "Do strict capital requirements raise the cost of capital? Bank regulation, capital structure, and the low-risk anomaly", *The American Economic Review*, Vol. 105, No. 5, and Andrea Frazzini and Lasse Heje Pedersen (2014), "Betting against beta", *Journal of Financial Economics*, Vol. 111, No. 1.

Estimated required returns

Chart 3.3



Note: The whole group is included in the calculations, i.e. also any subsidiaries such as mortgage banks and insurance companies, as well as foreign branches and companies. Hence, the entire Nordea group is included, not only the Danish activities. The risk-free interest rate is the same for all institutions, while risk premia are institution-specific.

Source: Bloomberg, Thomson Reuters Datastream, Consensus Economics and own calculations.

The decrease in the implied required returns reflects a fall in the risk-free interest rate to almost zero, as well as lower risk premium requirements as shareholders assess the institutions to be safer.

The wide spread in the required rates of return is attributable to both the risk-free interest rate and risk premia having fluctuated considerably over time. For example, the risk-free interest rate exceeded 5 per cent in 2008, but has fallen to a level close to zero since then.

The risk premium depends on shareholders' assessments of the risk on a bank share, but also on their risk aversion, i.e. how much compensation they require for a given risk. Both vary over time and therefore influence risk premia and the required rates of return.

The risk premium on a bank share depends on its systematic risk, i.e. conditions affecting the entire stock market, such as certain economic indicators, optimism, etc. This is a risk that cannot be avoided, and for which shareholders require compensation by way of a risk premium. The systematic risk on a given share may be higher or lower than the market risk. The covariation between price changes for the share and the stock market overall can be calculated and expressed via a "beta", which can be interpreted as the share's systematic risk relative to the market. The

higher beta is, the more risky the share is relative to the stock market as a whole.

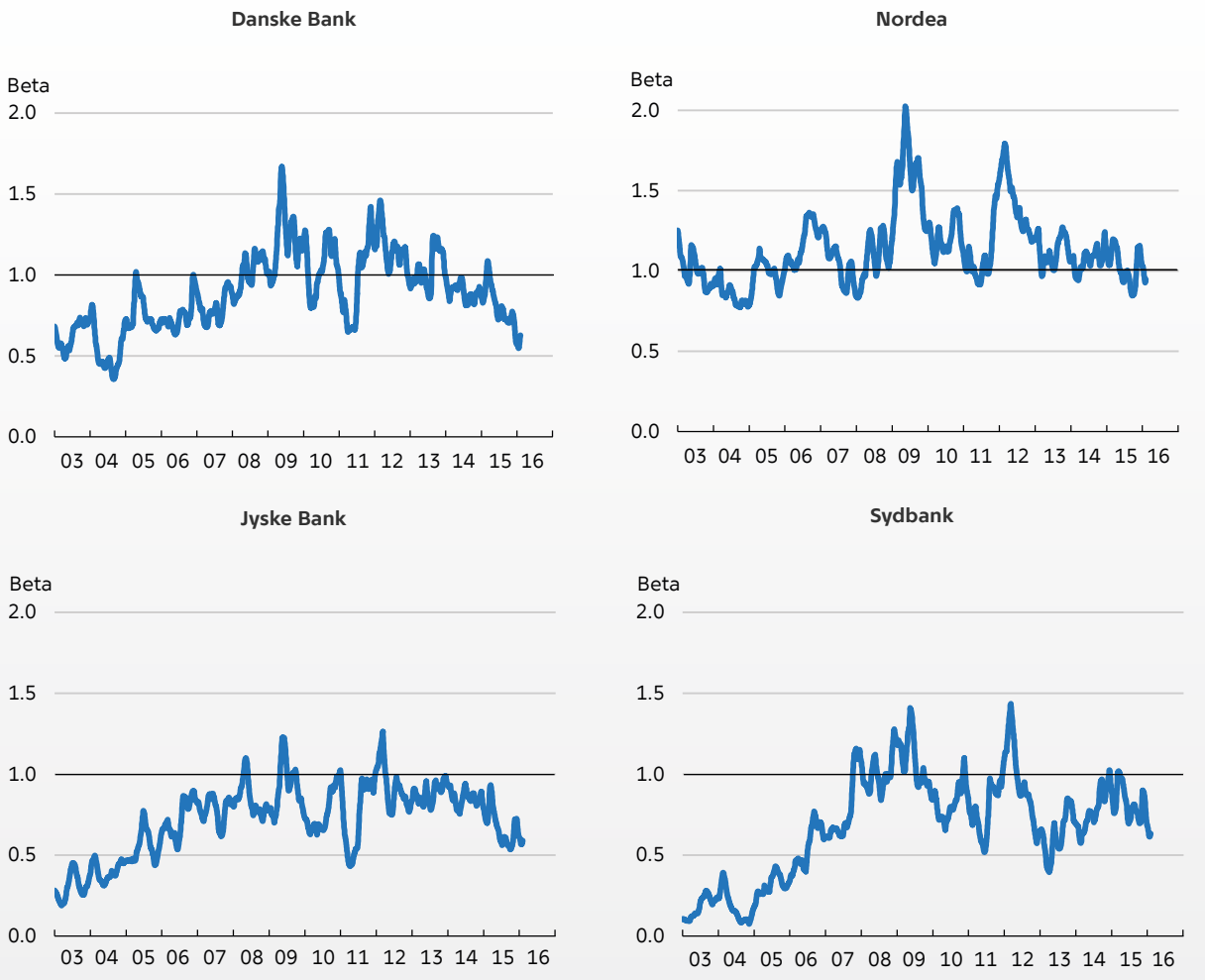
Changes in credit institutions' risk premia may therefore be attributable to changes in both market risk premia, cf. Chart A in box 3.1, and the beta values of bank shares, cf. Chart 3.4.

The institutions' beta values rose considerably up to and during the financial crisis, when shareholders assessed bank shares to be more risky than the stock market as a whole. From mid-2009, the institutions' beta values began to fall, reflecting reduced turmoil in the financial markets, as well as lower risk on Danish credit institutions due to the unlimited government guarantee under Bank Rescue Package I and the institutions' access to individual government guarantees under Bank Rescue Package II.

Towards the end of 2011 and in early 2012, beta values soared again. This coincided with the uncertainty related to the sovereign debt crisis in Southern Europe. Since then, the institutions' beta values have fallen, to a level below one at present. In other words, shareholders now assess bank shares to be safer than the stock market as a whole. This may reflect the institutions' increased capitalisation and collateral requirements in recent years, as well as their improved liquidity reserves.

Estimated beta values

Chart 3.4



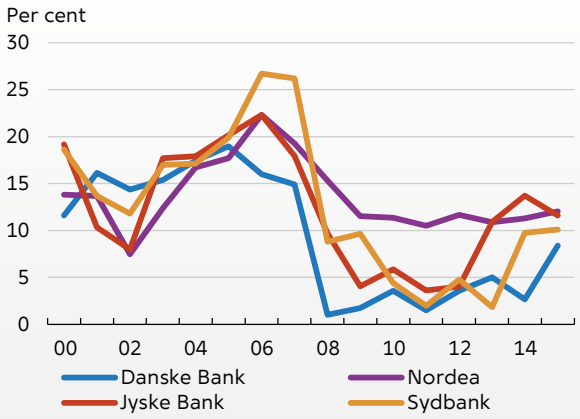
Note: Beta has been smoothed using an exponential filter. The whole group is included in the calculations, i.e. also any subsidiaries such as insurance companies, as well as foreign branches and companies. Hence, the entire Nordea group is included, not only the Danish activities. Jyske Bank and Sydbank have grown during this period, which has increased their exposure to European shocks. As a result, the covariation of their shares with the European stock market, Euro Stoxx 600, has risen, so that their beta values have increased. By comparison, Nordea is a large, international banking group throughout the period under review, and hence the price of its shares is more strongly influenced by the European market.

Source: Bloomberg and own calculations.

ROE AND THE RATE OF RETURN REQUIRED BY SHAREHOLDERS

The return on the credit institutions' equity fluctuates considerably over time. Their ROE, i.e. profit relative to the *book value of equity*, was very high in the years just before the financial crisis, after which it dived sharply, cf. Chart 3.5. In recent years, profits have grown, partly due to lower loan impairment charges, and in 2015 the four largest credit institutions in Denmark had ROEs ranging from 8 to 12 per cent.

Return on equity Chart 3.5



Note: Profit after tax relative to the average book value of equity over the year.
Source: Danish Financial Supervisory Authority.

Danske Bank's ROE has been reduced by write-downs on goodwill over the last couple of years. Adjusted for this, Danske Bank is more or less on a par with the other credit institutions.

The institutions' actual ROE can be assessed relative to how much shareholders expect in return on the *book value of equity*. This can be calculated on the basis of the price paid by the shareholders for the shares and their implied required returns in relation to the *market value of equity*, cf. Box 3.2.

In 2015, shareholders traded bank shares at prices that, according to the calculations in this chapter, reflected expected future annual returns on the *book value of equity* averaging 5.6 to 11.2 per cent, cf. Table 3.1.

Hence, the credit institutions' ROE in 2015 exceeded the shareholders' expectations of the average annual return on the book value of equity over time. The reason could be that loan impairment charges are currently very low and therefore shareholders do not expect future profits to match the 2015 level.

THE CREDIT INSTITUTIONS' ROE TARGETS ARE HIGHER THAN THE SHAREHOLDERS' REQUIREMENTS

The managements of several Danish banks have announced target returns of up to 12.5 per cent p.a. on the book value of equity. For some banks, these targets are for 2016, while others have set a later date, e.g. 2018.

ROE and shareholders' required return, 2015 Table 3. 1

	Required return on equity	Equity, market value relative to book value	Expected return on book value of equity	Actual ROE	Targeted ROE
Danske Bank	6.0	1.28	7.7	8.4	12.5
Nordea	7.5	1.50	11.2	12.0	n.a.
Jyske Bank	5.1	1.10	5.6	11.6	7.8
Sydbank	4.9	1.52	7.4	10.1	12.0

Note: Averages for 2015. The required rate of return on equity is the shareholders' required return on the institutions' shares, cf. the calculations in Box 3.1. The actual ROE is the profit after tax relative to the book value of equity. Jyske Bank targets an ROE of 10 per cent before tax in 2016; in the table this has been converted into an ROE after tax based on a tax rate of 22 per cent. The targets are for 2016 for Jyske Bank and Sydbank and by 2018 for Danske Bank. Nordea does not state any quantitative target for its ROE.
Source: Bloomberg, SNL Financial, Thomson Reuters Datastream, Consensus Economics and own calculations.

Shareholders' expected return on book value of equity and required return on market value of equity.

Box 3.2

The credit institutions' ROE is their profit relative to the book value of equity. Hence, the ROE should be seen relative to how much shareholders expect in return on the book value of equity – not their required return on the market value of equity, which has been calculated above.

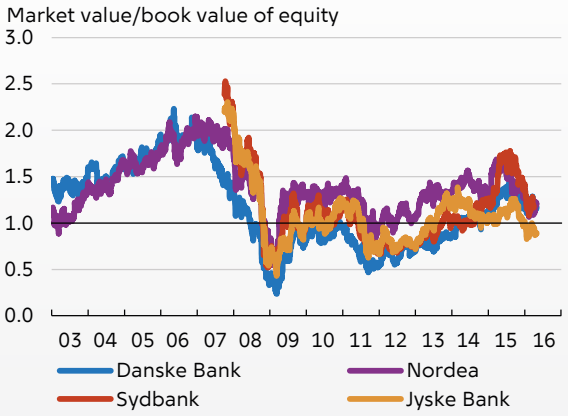
Shareholders' expected return on the book value of equity can be found by means of the implied required return on the market value of equity. This is done by using the formula

$$\text{Expected rate of return on book value of equity} = \text{Required rate of return on market value of equity} \times \frac{\textit{Market value of equity}}{\textit{Book value of equity}}$$

The market value of equity is given by the price shareholders are paying for the shares. The market value is seldom equal to the book value, cf. Chart B. For example, the market value of equity for Nordea and Sydbank was, on average, 1.5 times higher than the book value in 2015. Consequently, shareholders' expected return on the book value of the two institutions' equity was 1.5 times higher than the required return on the market value of equity.

So it is important to distinguish between the return on the book value of equity expected by the shareholders and shareholders' implied required returns for the market value of equity. Both are often simply referred to as shareholders' required return without any indication of whether it is the return on the book value or market value.

Chart B: Market value of equity relative to book value of equity



Source: Bloomberg.

If an institution issues new equity, e.g. in the form of shares, the shares will be sold at market value. This income accrues to the institution and will increase the book value of equity. So for newly issued shares the market value and the book value are equal. This means that when an institution issues new shares, shareholders' required return on the market value of equity is relevant, and *not* the required return on the book value of total equity.

These targets are somewhat higher than the shareholders' current expected returns on the book value of equity, judging from the prices at which bank shares are traded, cf. Table 3.1. This indicates that the institutions can deliver lower returns than the targets announced and still satisfy their shareholders.

Danske Bank's and Sydbank's targeted ROEs after tax of 12.5 per cent in 2018 and 12 per cent in 2016, respectively, are higher than their actual ROEs in 2015, although the latter were boosted by very low loan impairment charges. Danske Bank did, however, write down its goodwill in 2015, but even adjusted for this the ROE was 11.6 per cent and thus still lower than the target for 2018.

Jyske Bank has a lower ROE target than the other two banks and in 2015 achieved a higher ROE than the target announced for 2016.

HIGHER ROE CAN INCREASE THE INSTITUTIONS' RISKS

The ROE targets should be viewed against the background of a risk-free interest rate that is close to zero. So if the targets are to be met, the institutions must generate a considerable excess return relative to a Danish government bond, which is virtually risk-free.

The ROE depends on the institution's profit and how much equity this profit is to be distributed on, i.e.

$$\text{Return on equity} = \frac{\text{Profit}}{\text{Equity}} = \underbrace{\frac{\text{Profit}}{\text{Assets}}}_{\text{Return on assets}} \cdot \underbrace{\frac{\text{Assets}}{\text{Equity}}}_{\text{Leverage}}$$

The profit depends on the institutions' costs and income. Effective cost management and sound credit policies, so that there are no disproportionally large losses, contribute to increasing profits. A large profit may also reflect high interest margins, fees and similar. The less competition there is, the more the institutions can raise prices.

If an institution expects loan impairment charges to be very low in the coming years, e.g. due to favourable economic conditions, it will expect larger profits and hence a higher ROE in these years. This means that a high ROE target can be met in years with low loan impairment charges, but not over a longer period.

It is uncertain how the institutions set their ROE targets, and whether the targets apply for a few years only or for a longer period.

If an institution cannot meet its ROE target in years with very low loan impairment charges or by reducing costs or raising prices, an alternative way of boosting profits it to achieve a higher return on its assets by providing more risky loans, on which the rate of interest is higher. This will increase profits if all goes well, but over time it may also lead to greater losses. Hence, ROE will fluctuate more, and it will be necessary to adjust the ROE targets for individual years on a current basis.

Alternatively, the institution can achieve a higher ROE by increasing its leverage, i.e. by funding a smaller part of its assets by means of equity. In principle, profits are independent of asset funding sources, cf. above, but a higher leverage ratio means that the profit is to be distributed on fewer kroner of equity. This increases the return per krone of equity. However, the institution's capitalisation deteriorates, thereby making it less resilient to losses. In other words, higher leverage makes the institution more risky.

Due to the higher risk on more risky loans or a higher leverage ratio, shareholders will require a higher risk premium for investing in the bank share. As a result, shareholders' required ROE will also increase.

If the institutions want to meet their ROE targets solely by increasing their leverage ratio, it must be increased considerably, cf. Box 3.3. In fact, the leverage ratio must be raised to a level more or less matching that seen in the years leading up to the financial crisis, when several institutions turned out to be too weakly capitalised.

Furthermore, a high leverage ratio can make it difficult for a credit institution to meet potential future leverage requirements, cf. Chapter 4, "Capital requirements and risk weights", in this issue of *Financial stability*.

ROE and leverage ratios at book values

Box 3.3

A credit institution's leverage ratio affects the size of its ROE. So if an institution wishes to achieve a higher ROE, it can increase its leverage ratio. However, this will also increase the institution's risks as it then has less equity to absorb losses.

An institution's profit and hence its ROE varies strongly over time, reflecting e.g. changes in the risk-free interest rate and fluctuations in loan impairment charges. To adjust for this, an institution's average return on assets for the period 2000-15 is calculated. This provides an estimate of the ROE given a normal return on assets. It is a very rough estimate, which does not take into account any changes in the composition of the assets during the period in question. The assets held by the institution today may therefore yield a normal return that differs from the average applied. Furthermore, no adjustment is made for variations in costs and investments. All the same, the estimate can be used to illustrate the significance of leverage to the ROE. It can also give an indication of the required leverage ratio if the institution is to meet its ROE target in a year with an average return on assets.

The leverage ratios of Danske Bank, Jyske Bank and Sydbank were within the interval 12-19 at end-2015. If 2015 had resulted in an average return on assets, their ROEs would have been between 6.0 and 8.4 per cent, cf. the table below. This is lower than their ROE targets. If they want to meet their targets via higher leverage and the return on assets is given by the average for 2000-15, this simple approach shows that Danske Bank in particular must increase its leverage ratio considerably.

Return on equity and leverage ratios of Danish credit institutions

	Average return on assets after tax 2000-15, per cent	Leverage ratio, 2015	ROE if average return on assets and leverage ratio are the same as in 2015, per cent	Targeted ROE after tax, per cent	Leverage ratio if target is to be met
Danske Bank	0.32	18.8	6.0	12.5	38.8
Jyske Bank	0.39	18.9	7.3	7.8	20.2
Sydbank	0.67	12.6	8.4	12.0	17.9

Note: For Sydbank, the average return on assets after tax is for the period 2002-15. Jyske Bank includes BRF throughout the period. The leverage ratio has been calculated as total assets relative to book value of equity. Jyske Bank targets an ROE of 10 per cent before tax in 2016; in the table this has been converted into an ROE after tax based on a tax rate of 22 per cent. The targets are for 2016 for Jyske Bank and Sydbank and by 2018 for Danske Bank. Nordea does not state any quantitative target for its ROE.

Source: Credit institutions' financial statements, Danish Financial Supervisory Authority and SNL Financial.

4

CAPITAL REQUIREMENTS AND RISK WEIGHTS

INTRODUCTION AND SUMMARY

The average Tier 1 capital ratio of Danish systemic credit institutions has risen considerably over the last decade. This is attributable to higher Tier 1 capital and a fall in calculated risks on the institutions' credit exposures.

Systemic credit institutions use IRB, Internal Ratings Based, approaches in the calculation of their risk weights. Institutions using IRB approaches estimate risks on individual exposures on the basis of e.g. their own data. This entails that risk weights should reflect the risks incurred by the institutions. The average risk weight is influenced, inter alia, by the interaction between macroeconomic developments and portfolio adjustments, but also by changes to calculation methods.

In 2008, most systemic credit institutions made the transition to IRB approaches for calculation of credit risks. This transition led to a fall in the average risk weight, since risk weights are generally lower when IRB approaches are used than when the standardised approach is used. After the transition, the average risk weight of corporate exposures calculated using IRB approaches has decreased, whereas it has increased a little for retail exposures.

Compared with simpler calculation methods, IRB approaches are better able to reflect the actual risks of a credit institution. This gives institutions an incentive to improve their risk management and portfolio structure, and it also contributes to ensuring appropriate capital allocation to the benefit of the economy.

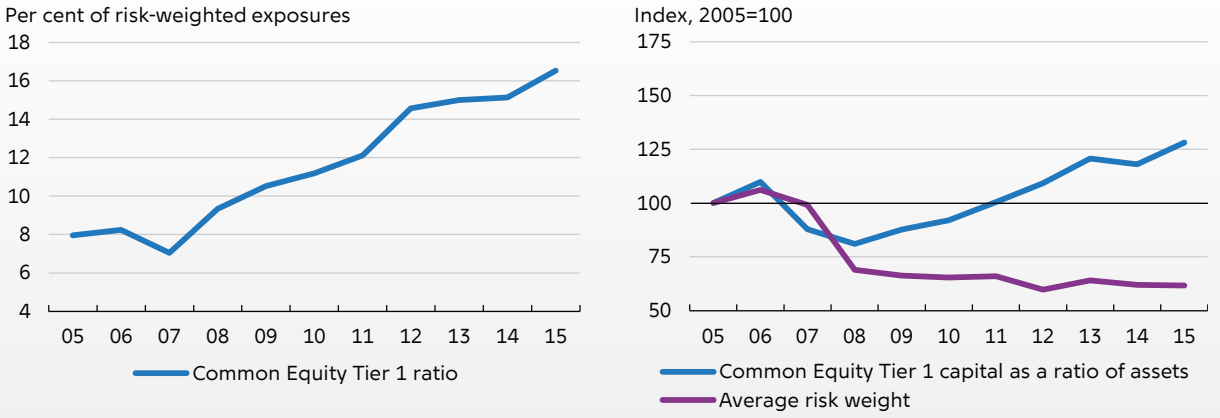
However, IRB approaches also entail challenges. Actual risks can be difficult to estimate, and if IRB approaches underestimate actual risks, the result is calculated risk weights that are too low. As a result, the capital ratio becomes higher than it should be, which will make the institutions appear more resilient than they actually are. This may have a negative impact on financial stability.

With a view to strengthening the framework for risk-based capital requirements, the Basel Committee has presented various proposals to address model risk and measurement errors under IRB approaches, among other issues. These measures comprise proposals for a leverage ratio, a capital floor and floors for the model parameters used in the calculation of risk weights in IRB approaches.

It is in the interest of Denmark to have a level playing field for credit institutions across national borders. Common requirements, standards and practices across countries provide a basis for enhanced competition in financial services for the benefit of customers. Uniform rules also benefit Danish institutions, as they can operate on the same terms across national borders. Moreover, to ensure confidence in Danish institutions, it is essential that they meet international investors' standards and expectations.

The Basel Committee's proposals imply that a *common* minimum limit may be imposed on all credit institutions, e.g. a floor for risk-weighted exposures. But setting a common limit is difficult, as the security of the institutions' credit exposures varies considerably. This may be attributable to different business models, but also to differences in structural factors across countries. For example, under Danish legislation, creditors are in a

Development in Common Equity Tier 1 ratio and underlying factors since 2005 Chart 4.1



Note: Systemic credit institutions. Total risk-weighted exposures.
Source: Danish Financial Supervisory Authority and credit institutions' financial statements.

relatively good position in the event of default on loans secured on real estate. This reduces credit institutions' risks and losses, which contributes to the very low Danish risk weights for such loans.

The Basel Committee's proposed measures may give credit institutions inexpedient incentives as they will enable the institutions to increase their risk without increasing their capitalisation if the measures are binding. Consequently, it is important that the Basel Committee's proposed measures do not prevent IRB approaches from working in cases where the estimated risk weights correctly reflect very low risks. The proposed measures should act only as backstops, meaning that the requirements should be binding only in cases where the risk weights have become too low.

Crude calculations indicate that the Basel Committee's proposal for a capital floor, which was published at the end of 2014, will increase risk-weighted exposures notably for the largest credit institutions in Denmark. It is important that the final design of the capital floor is sufficiently differentiated, so that fundamental factors related to credit risk are taken into account, e.g. differences in the rules on liability and default in the individual countries.

INTERNAL MODEL APPROACHES HAVE REDUCED RISK WEIGHTS

Overall, the Common Equity Tier 1 capital ratio for systemic credit institutions in Denmark[1] has risen substantially over the last decade, cf. Chart 4.1 (left). This is attributable to stronger growth in Common Equity Tier 1 capital than in assets, and to a decrease in the average risk weight, cf. Chart 4.1 (right).

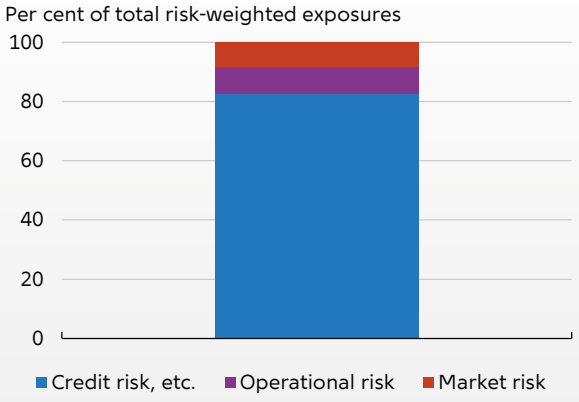
The Tier 1 capital ratio is a measure of the institutions' Tier 1 capital as a ratio of their total risk-weighted exposures. In simplified terms, it can be written as

$$\textit{Tier 1 capital ratio} = \frac{\textit{Tier 1 Capital}}{\textit{Risk-weights x exposures}}$$

The capital requirement rules are based on the principle that a credit institution's capitalisation should reflect its actual risk. The risk-based capital requirements are to ensure that the institutions have enough capital to absorb unexpected losses. Hence, an institution must calculate its risks of losses for each individual exposure, summarised in a risk weight. Low risk weights reflect that the institution

1 In this chapter, Danish systemic credit institutions, including their mortgage banks, comprise the following groups: Danske Bank, Nordea Bank Danmark, Nykredit, Sydbank, Jyske Bank and BRFkredit, which joined the Jyske Bank group in 2013.

Composition of risk-weighted exposures Chart 4.2

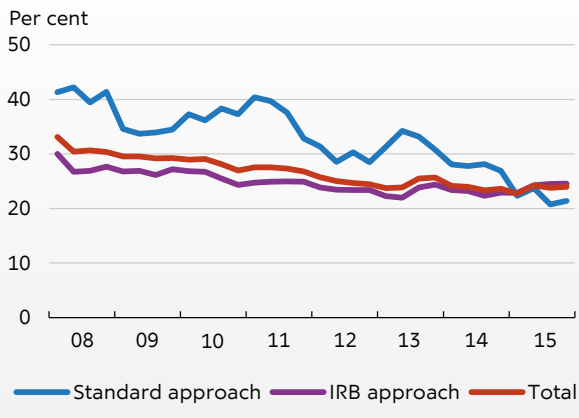


Note: Systemic credit institutions.
Source: Credit institutions' financial statements and risk reports 2015.

has calculated low risks on the individual credit exposures, and vice versa for high risk weights.

A credit institution calculates various types of risk, i.e. credit risk, counterparty risk, market risk and operational risk. The majority by far – around 80 per cent – of total risk-weighted exposures concern credit risk, cf. Chart 4.2. The rest of this chapter therefore focuses on the institutions' credit exposures.

Average risk weights for credit exposures by approach Chart 4.3



Note: Systemic credit institutions. Risk weights have been calculated as risk-weighted exposures as a percentage of total unweighted credit exposures.
Source: Danish Financial Supervisory Authority and own calculations.

TRANSITION TO IRB APPROACHES

In 2008, there was a relatively large decline in the aggregate average risk weight for systemic credit institutions in Denmark, cf. Chart 4.1 (right). The background is that several systemic institutions began to use IRB[2] approaches during 2008, subject to authorisation from the Danish Financial Supervisory Authority. Before 2008, all credit institutions applied the standardised approach.

Under the standardised approach, the exposures are divided into categories with fixed risk weights. That makes this approach simple and transparent, but not very sensitive to risk factors associated with individual customers. For instance, all housing loans are given the same risk weight if the loan-to-value, LTV, ratio is less than 80 per cent.

Institutions using IRB approaches must estimate one or more of the risk parameters behind the risk weights for each exposure on the basis of e.g. internal data. This makes the risk weights more sensitive to individual customer characteristics, e.g. income and LTV ratio. Risk weights on housing loans may thus differ from customer to customer.

The risk weights for the individual credit exposures are calculated by inserting the estimated risk parameters into fixed formulas, cf. Appendix 4.1. The estimated risk weights under the IRB approach are often considerably lower than the fixed risk weights under the standardised approach. The transition to IRB approaches thus led to an expected fall in the institutions' average risk weight, which lifted the Tier 1 capital ratio.

In order to prevent a too low capital requirement after the transition to IRB approaches, transition rules were introduced implying that, in Denmark, the institutions' capital base must not be lower than 80 per cent of the minimum requirement calculated according to the previous rules.[3]

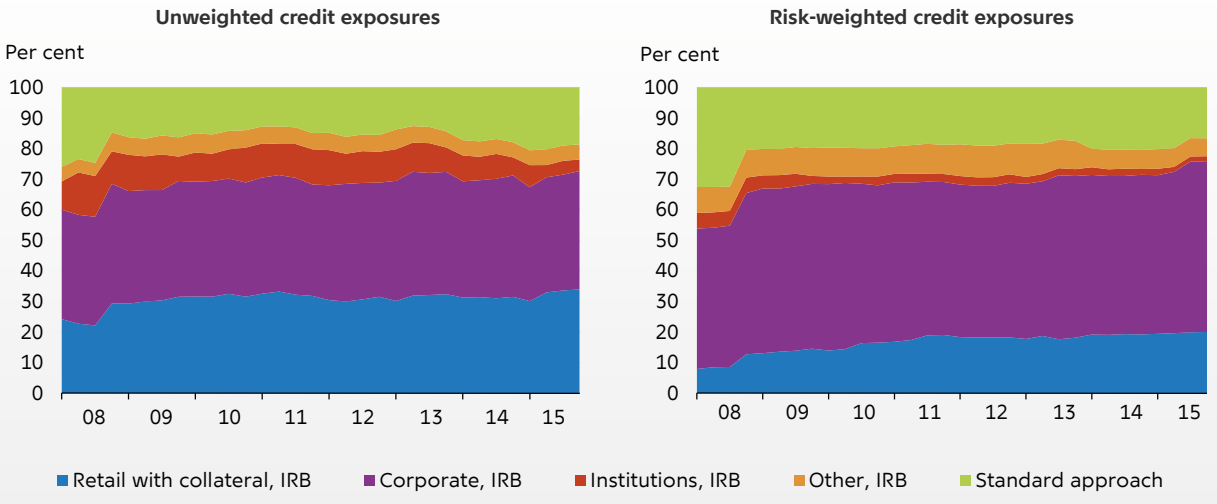
CREDIT INSTITUTIONS' AVERAGE RISK WEIGHT HAS DECLINED AFTER 2008

Since the beginning of 2008, the average risk weight for systemic institutions' credit exposures has declined by around 9 percentage points overall, cf. Chart 4.3. In other words, an average credit exposure of kr. 1,000 was calculated at approximately

2 Internal Ratings Based.

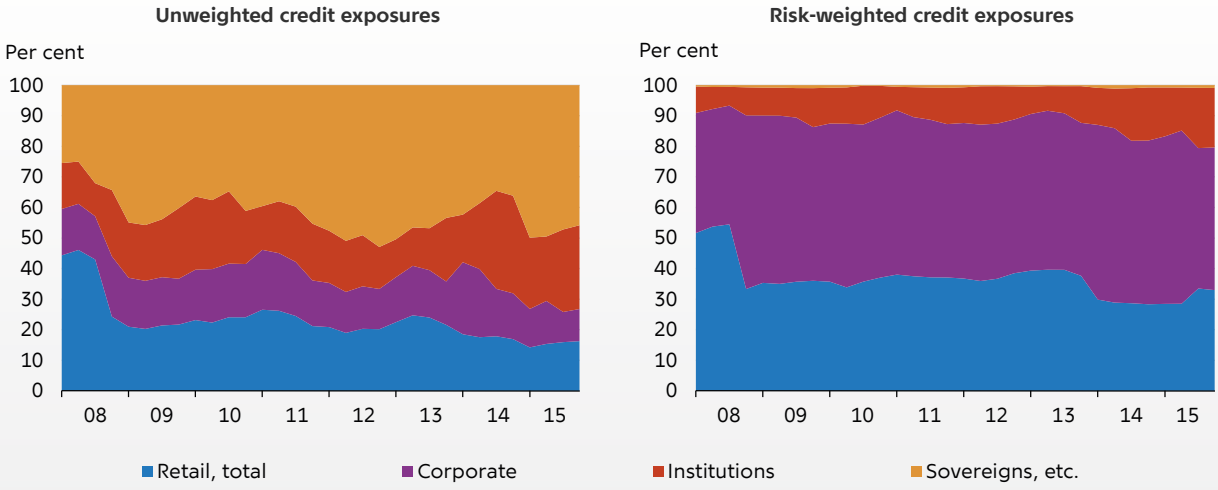
3 Unless otherwise agreed, the transitional rules, or the Basel I floor, apply until 31 December 2017. The Basel I floor may be replaced by another permanent floor, cf. Box 4.1.

Distribution of credit institutions' exposures Chart 4.4



Note: Systemic credit institutions.
Source: Danish Financial Supervisory Authority and own calculations.

Distribution of institutions' credit exposures calculated using the standardised approach Chart 4.5



Note: Systemic credit institutions. Unweighted credit exposures calculated using the standardised approach account for only a minor share of the systemic institutions' total credit exposures, cf. Chart 4.4. Sovereigns, etc. covers, inter alia, exposures to central governments, central banks and local authorities.
Source: Danish Financial Supervisory Authority and own calculations.

kr. 240 after risk weighting at the end of 2015, compared with around kr. 330 at the beginning of 2008.

The drop in the institutions' average risk weight for credit exposures is primarily attributable to a decrease in the average risk weight for exposures calculated using the standardised approach and a decline in the average IRB risk weight for corporate exposures.

Decline in average risk weight for credit exposures calculated using the standardised approach

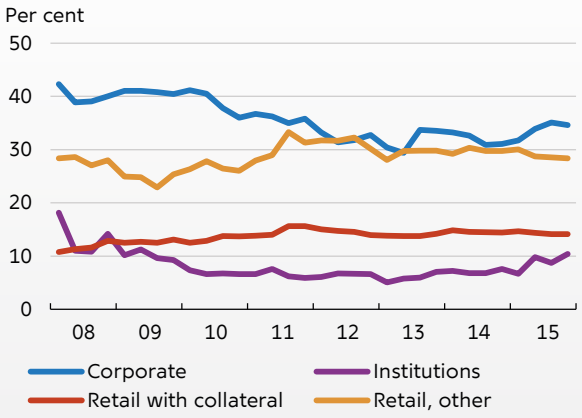
A smaller part – less than 20 per cent – of the IRB institutions' portfolios is still calculated using the standardised approach, cf. Chart 4.4 (left). Overall, the average risk weight for these exposures has declined since 2008. This is attributable to portfolio adjustments, given that the risk weights

for the overall exposure categories are fixed. In other words, there has been a shift in portfolio structures towards exposures with lower risk weights. Since 2008, the share of retail exposures calculated using the standardised approach has fallen, while the share of exposures to sovereigns and institutions has risen, cf. Chart 4.5 (left). Since retail exposures have a higher risk weight in the standardised approach than sovereign exposures, which have a risk weight of zero, this entails a lower average risk weight for exposures calculated using the standardised approach.

When an institution has obtained an IRB authorisation from the Danish Financial Supervisory Authority, IRB approaches must, as a main rule, be used for all exposure categories, unless the institution has been exempted by the Danish Financial Supervisory Authority and allowed to use the standardised approach instead. The variation over time in the average risk weight for exposures calculated using the standardised approach should be viewed in the light of such exemptions, among other factors. The institutions may subsequently be authorised to apply IRB approaches to selected portfolios, e.g. in subsidiaries.

Average risk weights for credit exposures calculated using the IRB approach

Chart 4.6



Note: Systemic credit institutions. Risk weights have been calculated as risk-weighted exposures as a percentage of total unweighted credit exposures.
Source: Danish Financial Supervisory Authority and own calculations.

Decline in average IRB risk weight for corporate exposures

The average risk weight for corporate exposures calculated using IRB approaches has fallen since 2008, cf. Chart 4.6. In general, corporate exposures have the highest average risk weights and also constitute one of the largest exposure types. This means that corporate exposures account for more than half of the institutions' total risk-weighted exposures, cf. Chart 4.4 (right). The lower average risk weight for corporate exposures has thus pushed the overall IRB risk weight downwards since 2008.

Among the drivers of the development in the average IRB risk weight are the institutions' estimated risk parameters, PD and LGD, which are used in the calculation of risk weights. PD, Probability of Default, is the probability of default on a loan within the coming year. LGD, Loss Given Default, is the expected loss ratio given default on the loan. The risk weight increases linearly with LGD and non-linearly with PD, i.e. the risk weight changes more at low PD values than at high PD values, cf. Appendix 4.1. On the basis of aggregate data, it is possible to make an overall assessment of how PD and LGD have driven the development in the average risk weight.

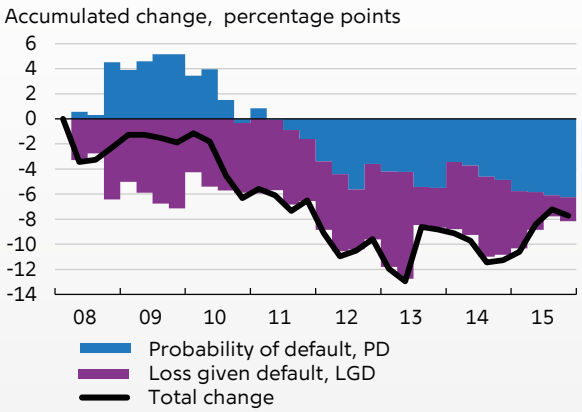
A lower LGD has contributed to the fall in risk weights for corporate exposures, cf. Chart 4.7. Part of the drop in LGD can probably be attributed to increased collateralisation after the financial crisis.

In recent years, the decline in the average risk weight for corporates has to a large extent been driven by a lower PD. The PD rose in the years immediately after the financial crisis, driving up risk weights. This should be viewed in the light of a strong rise in the number of defaults combined with a general economic slowdown. Subsequently, the number of defaults has declined and the economy has improved.[4] Another driver of the fall in the PD may be that model improvements have made PD estimates more accurate. All else equal, the high level of defaults in the years following the financial crisis provides better statistical data basis for the institutions' estimation purposes.

4 Data comprises all credit exposures of systemic credit institutions, including exposures in other countries than Denmark. The systemic credit institutions account for 70 per cent of total lending in Denmark.

Changes in risk weights for corporate exposures calculated using the IRB approach, broken down by contributions from estimated risk parameters

Chart 4.7

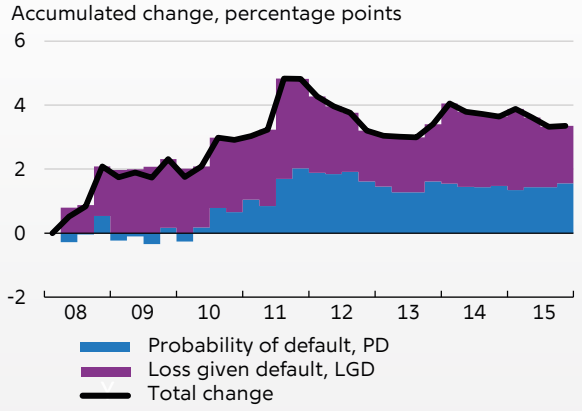


Note: Systemic credit institutions. Risk weights have been calculated as risk-weighted exposures as a percentage of unweighted credit exposures. The accumulated growth contributions have been broken down on the basis of a first degree Taylor approximation. Besides PD and LGD, a small contribution from maturity adjustment for corporate exposures is included (not shown). The data contains exposures calculated using the Foundation IRB approach, F-IRB, or the Advanced IRB approach, A-IRB, cf. also Appendix 4.1. For corporate exposures, only institutions using A-IRB models must estimate LGD themselves.

Source: Danish Financial Supervisory Authority and own calculations.

Changes in risk weights for retail loans secured on real estate calculated using the IRB approach, broken down by contributions from estimated risk parameters

Chart 4.8



Note: Systemic credit institutions. Risk weights have been calculated as risk-weighted exposures as a percentage of unweighted credit exposures. The accumulated growth contributions have been broken down on the basis of a first degree Taylor approximation.

Source: Danish Financial Supervisory Authority and own calculations.

Moreover, the lending portfolio has changed after the financial crisis. Among other factors, the institutions have made considerable loan impairment charges, so that the risk on the remaining loan portfolio should be expected to have diminished.

Higher average IRB risk weight for secured retail exposures

Besides corporate exposures, retail exposures secured on real estate constitute one of the largest exposure types, cf. Chart 4.4 (left). In Denmark, such exposures comprise primarily mortgages to households and corporates. Retail exposures secured on real estate have relatively low risk weights, cf. Chart 4.6. This should be viewed in the light of the historically very limited losses on mortgages.

The average IRB risk weight for secured retail exposures has risen slightly over the period, partially following the trend in the housing market. The LGD risk parameter rose in the years following 2008, cf. Chart 4.8. During that period, the housing market was weak with falling prices. Since then, a higher PD has also increased risk weights further. The rise in the PD in the years just after the eruption of the financial crisis can be viewed in the light of higher unemployment. Despite more favourable macroeconomic developments in recent years, aggregate PD has been relatively constant. However, there may be fluctuations in PD for the underlying sub-portfolios that are not captured in the aggregate data.

THE FRAMEWORK FOR RISK-WEIGHTED CAPITAL REQUIREMENTS MUST BE PRESERVED

AVERAGE RISK WEIGHTS VARY ACROSS CREDIT INSTITUTIONS

Internationally, it has given cause for concern that calculated risk weights may differ substantially across credit institutions.[5] The strong variation may entail that the risk weights of some institutions have become too low relative to actual risks. The European Banking Authority, EBA, finds that supervisory practices vary across countries, resulting in different risk weights for otherwise uniform exposures.[6] Moreover, national differences in other factors

5 See e.g. Basel Committee, *Reducing excessive variability in banks' regulatory capital ratios – A report to the G20*, November 2014.

6 See EBA, *Review on the consistency of Risk Weighted Assets.*

Average IRB risk weights by exposure category, June 2015 Table 4.1

Per cent	Corporate			Retail with security			Retail, other		
From institutions in: / To:	Denmark	Norway	Sweden	Denmark	Norway	Sweden	Denmark	Norway	Sweden
Denmark	31	44	35	13	30	13	28	27	14
Norway	39	45	39	34	24	31	32	28	34
Sweden	40	34	27	13	12	4	36	23	24

Note: Credit exposures. The table is based on observations from EBA, *2015 EU-wide transparency exercise*. The table includes the following credit institutions that have reported geographical distribution: Danske Bank, Nykredit, DNB, Nordea, SEB, Handelsbanken and Swedbank.
Source: EBA, *2015 EU-wide transparency exercise*.

such as creditor rights or government guarantees for some loans may explain a part of the variation in risk weights.

Table 4.1 shows the average risk weights of Danish, Norwegian and Swedish institutions for exposures in Denmark, Norway and Sweden. For example, the average risk weights of Danish, Norwegian and Swedish institutions for corporate exposures in Denmark can be compared. This comparison could indicate whether there are substantial differences between the institutions' risk weights for the *same* type of exposures in the *same* country. However, the variation between institution portfolios due to factors such as different business models has not been taken into account.

The table shows some variation in average risk weights. The strongest variation is seen for retail exposures secured on real estate, where e.g. the average risk weights of Danish, Norwegian and Swedish institutions range from 4 to 31 per cent in Sweden.

International comparisons are made difficult by e.g. differences in supervisory practices, including application of Pillar II, which enables supervisory authorities to impose further capital requirements on an individual institution if some risks are not sufficiently covered by the minimum requirements under Pillar I. Among other things, the supervisory authorities may impose a Pillar II add-on where the institution's risk weights are not assessed to reflect actual risks. Consequently, the average risk weights in Table 4.1 should also be viewed in the light of varying supervisory practices. For example, in 2014 the supervisory authorities in Norway and Sweden tightened – in different ways – the risk weight requirements for housing loans in their respective countries. The Norwegian supervisory authority tightened the requirement via Pillar I, while the Swedish supervisory authority applied Pillar II. The very low average risk weight for Swedish institutions' exposures in Sweden should thus be viewed together with their higher Pillar II requirement.

Despite possible differences in supervisory practices and institutions' customer portfolios, the considerable variations in risk weights among institutions in the same country may indicate that different models may produce different risk weights which cannot be explained by differences in actual risks. Hence, international comparisons are useful as a baseline for assessing average risk weight levels. A more accurate assessment requires a more detailed data set.

The Danish Financial Supervisory Authority continually supervises the institutions' IRB models to ensure that they calculate actual risks. In several cases it has issued orders to adjust risk weights that were assessed to be too low. In addition to direct model supervision, the Danish Financial Supervisory Authority also performs cross-country benchmark analyses.[7]

7 The results of such benchmark analyses were included in e.g. the basis for the order on a 10 percentage point increase in the risk weights of corporate exposures that was issued by the Danish Financial Supervisory Authority to Danske Bank in 2013.

IRB MODELS MUST REFLECT ACTUAL RISKS IN THE BEST POSSIBLE WAY

It is important that the capital requirements reflect actual risks, since this ensures that the institutions have sufficient capital for absorbing losses. Moreover, since the internal model approaches have a higher degree of risk sensitivity than the standardised approaches, they give the institutions an incentive for better risk management and a better portfolio structure. This contributes to ensuring appropriate capital allocation to the benefit of the economy.

A fair risk calculation is a precondition for risk-based models to perform as intended. But this presents difficulties as actual risks are not directly observable. IRB models use distributions of historical data to estimate risk parameters for calculation of risk weights. However, due to uncertainty and structural breaks, historical data does not always reflect the actual conditions. Furthermore, there is a risk that the assumptions used in the IRB models are not fulfilled in the real world. If the models underestimate actual risks, resulting in too low calculated risk weights, the resultant higher capital ratio will make the institutions appear more resilient than they actually are. This may have a negative impact on financial stability.

Models are not able to estimate the exact actual risks. In order to ensure the best possible reflection of actual risks in the estimated risk weights, it is important to develop IRB models continuously and to ensure sufficient data.

NEW PROPOSALS FOR NON-RISK-WEIGHTED CAPITAL REQUIREMENTS

With a view to strengthening the framework for risk-based capital requirements, the Basel Committee has presented various proposals to address model risk and measurement errors in internal model approaches, among other issues. These measures comprise proposals for a leverage ratio, a capital floor and floors for the model parameters used for calculation of risk weights in IRB models, cf. Box 4.1. These measures are intended to function as backstops for the risk-based capital requirement, thereby contributing to supporting financial stability. However, there is a risk that the measures will hinder the risk-based approach if they are binding in situations where the calculated low risks reflect actual risks. In such cases, the capital requirement will not depend on the institution's specific risk.

The Basel Committee's proposed backstops have different structures. The leverage ratio, imposing a minimum requirement on a credit institution's capital base relative to its *unweighted* exposures, does not alter the calculation of the institution's risk-weighted exposures. This means that the capital ratios, which are calculated relative to risk-weighted exposures, are also unchanged. Since the leverage ratio supplements the risk-based capital requirement, both requirements must be met. In contrast, the proposals to introduce floors for risk-weighted exposures and model parameters are a way to adjust IRB approaches. Binding floors will increase risk-weighted exposures and thus reduce the calculated capital ratio.

NON-RISK-WEIGHTED REQUIREMENTS MAY ENTAIL INEXPEDIENT INCENTIVES

According to the Basel Committee, the leverage ratio and the proposed floor for risk-weighted exposures complement each other. For instance, the leverage ratio may protect against unsustainable increases in leveraging, which could otherwise occur, given the risk-weighted capital requirement, in the event of strong growth in exposures with low risk weights. However, as opposed to the capital floor, the leverage ratio cannot contribute to reducing the differences between risk weights across institutions.

The leverage ratio and the floor for risk-weighted exposures may, however, entail inexpedient incentives as they are to function primarily as protection against too low risk weights. For example, if the leverage ratio is the binding requirement, it may give the institutions an incentive to take on more risky exposures on their balance sheets until the risk-weighted capital requirement becomes binding. The reason is that the required amount of capital is the same as long as the leverage ratio is binding, no matter if exposure risks increase. This allows the institution to increase its risks and thus to obtain higher revenue via higher risk premia on its lending without having to increase its equity.

The Danish government's expert group on a leverage ratio for credit institutions published its recommendations in December 2015. The expert group recommended that risk-based capital requirements should still be the backbone of capital

Proposals for backstops for risk-weighted capital requirements calculated using IRB approaches

Box 4.1
Continues

Basel III is the Basel Committee's attempt to address the weaknesses in the international banking system which became evident during the financial crisis. Special focus has been on improving the risk-weighted capital requirements by increasing the capitalisation requirements for institutions in terms of both amounts and quality. In addition, work is underway to increase confidence in institutions' risk-weighted exposures, including by preventing them from becoming too low. This has given rise to proposals for e.g. various backstops.

Leverage ratio

In 2010, as part of Basel III, the Basel Committee proposed a leverage ratio for credit institutions, i.e. the institutions' capital base relative to unweighted exposures.[1] The Committee proposed a leverage ratio of 3 per cent, meaning, in simplified terms, that the institutions may lend no more than 33 times their equity.

The leverage ratio is often motivated by saying that it will act as a backstop for the risk-weighted capital requirement. Being a relatively simple and transparent requirement, it may protect against model uncertainty and measurement errors when calculating the risk-based capital requirement.

According to the Basel Committee, a leverage ratio may also protect against excessive on- and off-balance sheet leveraging. This could potentially mitigate the risk of a deleveraging process, i.e. the risk of institutions reducing their balance sheets too quickly in a crisis, which could have a negative impact on the financial system and the real economy. However, there may be cases where a leverage ratio would increase the need for deleveraging. This applies e.g. to institutions with several types of exposures with different risk weights. The reason is that the risk-based capital requirement – as opposed to the leverage ratio – distinguishes between exposures with different risk weights, exposures with higher risk weights requiring more equity than exposures with low risk weights. Thus, the financing of exposures with high risk weights cannot be leveraged to the same extent under the risk-based capital requirement as under the leverage ratio, implying a reduced need for deleveraging.[2]

In the EU, the leverage ratio has been a disclosure requirement since 2015. Moreover, as from 2018 it may become a binding requirement under the Capital Requirements Regulation. This will be decided in 2017 on the basis of a report from the European Commission, which must be completed by the end of 2016 at the latest.

Basel I capital floor

The European capital requirement rules contain a Basel I floor regarding the capital requirement for IRB institutions. According to the floor requirement, a credit institution's capital base must constitute at least 80 per cent of the capital requirement calculated according to the Basel I rules. The Basel I capital requirement was 8 per cent of risk-weighted exposures. The Basel I floor is a transitional scheme which has been extended until the end of 2017.[3]

New permanent capital floor

In December 2014, the Basel Committee proposed a new permanent capital floor to replace the current temporary Basel I floor.[4] It seems that the new floor will be set as a bottom limit for the risk-weighted exposures of IRB institutions, the limit being set as a certain share of risk-weighted exposures calculated using the standardised approach.[5]

The proposal is very roughly outlined. For example, the Committee states that the floor may be calibrated within the range 60-90 per cent of risk-weighted exposures calculated using the standardised approach. It also remains to be clarified whether the requirement will be for one aggregate floor or granular floors, e.g. for each risk category.

The Committee emphasises, inter alia, that the floor will be able to mitigate the effects of potentially applying too low risk weights when using IRB models due to model risk and measurement errors. The floor may also improve comparability between institutions, as it provides a narrower range for calculated risk-weighted exposures between IRB institutions. Furthermore, the floor involves a link to the standardised approach, providing for a more level playing field for institutions irrespective of whether they use the standardised approach or the IRB approach.

The Basel Committee is working on a revised version of the proposal. The proposal may subsequently be suitable as the basis for implementation into European legislation.

Parameter floors

In March 2016, the Basel Committee published a proposal for introducing bottom limits for the model parameters which the institutions use in their IRB models.[6] These include floors for the probability of default, PD, and for loss given default, LGD, for corporate exposures, mortgages and qualifying revolving retail exposures.

The proposed PD floor is 0.05 per cent for both corporate and retail exposures, but 0.1 per cent for revolving lines of

1. The calculation of the leverage ratio is rather more complex in the Basel Committee's proposal than outlined here. Overall, the proposal envisages a numerator consisting of Common Equity Tier 1 capital and Additional Tier 1 capital, while exposures consist of on- and off-balance sheet exposures, derivatives, repos, etc. The value of these exposures is calculated in different ways to ensure the comparability of calculated leverage ratios across countries. For more details, see the report *Ekspertgruppe om gearingskrav for kreditinstitutter* (Group of experts on a minimum leverage-ratio for credit institutions – in Danish with a summary in English), Ministry of Business and Growth, 2015.
2. For further details, see Danmarks Nationalbank, Leverage ratio, *Financial stability*, 1st Half 2014.
3. The Basel I floor may be extended, cf. Article 500 of the CRR. Before 1 January 2017, the Commission must present a report to the European Parliament and the Council about the appropriateness of applying the Basel I floor after 31 December 2017 in order to ensure a backstop system for IRB approaches. This assessment is to take into account factors such as international developments and internationally agreed standards.
4. See Basel Committee, *Capital floors: the design of a framework based on standardised approaches*, December 2014.
5. The Basel Committee has also proposed to revise the standardised approach for calculating risk-weighted exposures, see Basel Committee, *Revisions to the Standardised Approach for credit risk – second consultative document*, December 2015.
6. See Basel Committee, *Reducing variation in credit risk-weighted assets – constraints on the use of internal model approaches*, March 2016.

Continued Box 4.1

credit. The proposal entails higher PD floors compared with the current CRR requirement, which operates with a PD of at least 0.03 per cent for institution, corporate and retail exposures.

As regards LGD, the floor will depend on whether the exposure is corporate or retail, secured and if so the type of collateral. For instance, the proposal suggests an LGD floor of 15 per cent for both corporate and retail exposures secured on commercial or residential real estate. The proposal represents a tightening relative to the existing rules. The reason is that the floor is to apply to far more exposure types than is the case now, and that it is to apply to individual exposures, not an average. The CRR thus only requires floors of 10 and 15 per cent, respectively, for the institutions' exposure-weighted *average* LGD for retail exposures secured on residential and commercial real estate.

The purposes of the Committee's proposals include reducing regulatory complexity and avoiding excessive and unwarranted differences in institutions' risk weights, and hence capital requirements, due to their use of different models and data.

Constraints on the use of IRB approaches

Moreover, the Basel Committee envisages constraints on the use of IRB approaches for calculation of the regulatory capital requirements resulting from credit risk. Among the Committee's proposals is to remove the option to use IRB approaches for calculating risk weights for equities, banks and other financial institutions as well as large corporates with total assets exceeding 50 billion euro. Instead, the risk weights are to be given using the standardised approach. As regards exposures to corporates with annual revenues exceeding 200 million euro, the Committee proposes that the institutions should have the option to estimate PD only.

One of the reasons stated by the Basel Committee for these proposals is that the institutions do not have sufficient appropriate data on these exposures for estimating actual risks fully and consistently.

requirements regulation, just as these requirements should, as a main rule, be binding on the institutions. As a backstop for risk-based capital requirements, the expert group recommended that the government should endorse an EU-harmonised leverage ratio of initially 3 per cent under Pillar I.

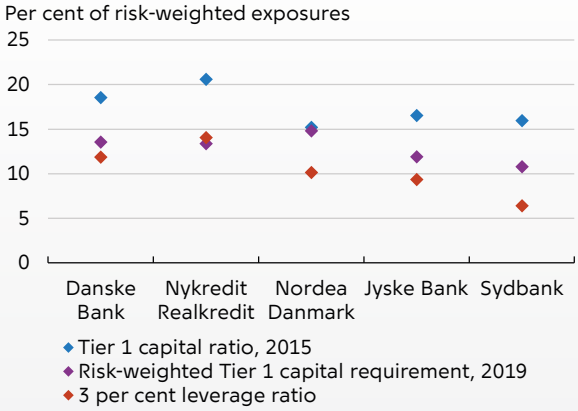
For most systemic credit institutions in Denmark, a leverage ratio of 3 per cent would not be the binding capital requirement at present, cf. Chart 4.9. The probability of a binding leverage ratio is highest for institutions with overall low risk weights. Today, the institutions' Tier 1 capital exceeds both a 3 per cent leverage ratio and their Tier 1 capital requirement in 2019 when the EU Capital Requirements Regulation, CRR, is fully implemented.

NON-RISK-WEIGHTED CAPITAL REQUIREMENTS ARE DIFFICULT TO SET

The Basel Committee's proposals for a leverage ratio, a capital floor and parameter floors envisage common minimum limits for credit institutions. The calibration of these limits plays an important role in the effectiveness of the measures. Given that the limits are minimum limits – which are to be set so low that they act as backstops – they will only be binding on institutions with low exposure risks, although high-risk exposures may also be associated with model risk and measurement errors.

Common minimum limits entail the risk that they will be binding in cases where the estimated risk weights under IRB approaches reflect actual risks. This indicates that the limits should not be set too high, as they would otherwise prevent institutions with very secure exposures from having capital requirements that reflect their very low risks.

Comparison of leverage ratio, risk-weighted Tier 1 capital requirement and Tier 1 capital ratio Chart 4.9



Note: Observations from end-2015. The Tier 1 capital requirement is the requirement that is currently expected to apply in 2019: a 6 per cent Tier 1 capital requirement, a fully phased-in capital conservation buffer of 2.5 per cent and a SIFI buffer requirement of 1-3 per cent after being fully phased in, depending on the systemic importance of the institutions. In addition, 75 per cent of the Pillar II add-on is also included, reflecting the executive order on capital requirements for the individual Pillar II add-on. The leverage ratio has been calculated on the basis of information in institutions' financial statements.

Source: SNL Financial and credit institutions' financial statements 2015.

Danmarks Nationalbank finds it important that the proposed measures should act only as backstops. They must not prevent IRB approaches from working in cases where the estimated risk weights correctly reflect low risks.

The possibilities offered by the existing regulatory regime should also be taken into account in the deliberations on setting minimum limits in the form of parameter floors, a capital floor and a leverage ratio. For instance, the authorities have certain powers to raise the minimum limits for applied risk weights, primarily for exposures secured on real estate.[8] In addition, Pillar II provides for setting a higher individual solvency requirement as a result of high leverage. The supervisory authorities may also increase the Pillar II requirement if they find that the risk weights do not reflect the institutions' actual risks.

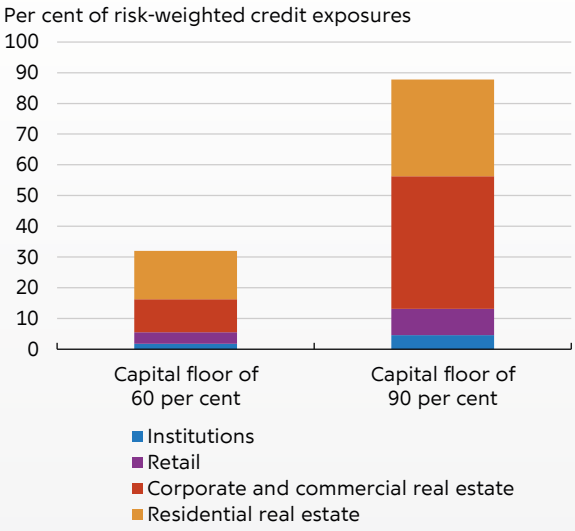
A capital floor may increase the risk-weighted exposures of the largest credit institutions in Denmark

The proposal for a capital floor may cause the calculated capital ratio to fall in the largest credit institutions in Denmark. The reason is that risk-weighted credit exposures calculated using the capital floor will – presumably – be higher than risk-weighted credit exposures calculated under the existing rules. Crude calculations based on the institutions' risk reports show that this applies irrespective of whether the calculation of the capital floor assumes that risk-weighted exposures are to account for 60 or 90 per cent of the risk-weighted exposures calculated using the standardised approach, cf. Chart 4.10.[9] It should be noted that the Basel Committee is working on a revised proposal, which is not yet known. The example is based on the draft published in 2014.

For Nykredit, Nordea and Jyske Bank, however, the final capital requirements will increase less than warranted by the rise in risk-weighted exposures. This is because the existing capital floor, the Basel I floor, is binding on them. Hence, their current capital requirements are higher than the capital requirements calculated on the basis of their risk-weighted exposures.

According to the calculations, the capital floor will increase the risk-weighted credit exposures of the largest credit institutions in Denmark, particularly as a result of their exposures to loans secured on residential and commercial real estate. This reflects the institutions' considerable real estate loans, inter alia through their mort-

Example of change in risk-weighted credit exposures in the four largest credit institutions as a result of a capital floor Chart 4.10



Note: Change in risk-weighted credit exposures by exposure category. The changes are calculated as weighted averages for the groups Danske Bank A/S, Nykredit, Jyske Bank A/S and Nordea AB. The example concerns only changes in risk-weighted exposures for selected credit exposure categories as a result of a capital floor compared with the current risk-weighted credit exposures. The new risk-weighted exposures have been calculated on the basis of the risk weights in Basel Committee, *Revisions to the Standardised Approach for credit risk – second consultative document*, December 2015. The calculations are simple, for instance only one risk weight applies to each exposure category, irrespective of whether several risk weights exist, depending on the exposure characteristics, e.g. LTV ratio for real estate. The risk weights applied using the standardised approach is 50 per cent for institutions, 80 per cent for corporates, 75 per cent for retail, 40 per cent for residential real estate and 90 per cent for commercial real estate.

Source: Credit institutions' risk reports 2015 and own calculations.

8 For instance it is possible – taking financial stability into account – to increase the risk weights of exposures secured on real estate for institutions using the standardised approach and to raise the exposure-weighted average LGD floor for retail exposures secured on real estate for institutions using IRB approaches.

9 The calculations include only the effects that can be calculated directly on the basis of information in the institutions' risk reports. It implies, inter alia, that no account is taken of higher conversion factors which translate off-balance sheet exposures into corresponding on-balance sheet exposures in the calculation of risk-weighted exposures. In addition, only limited adjustment is made for risk substitution, e.g. in the event of public authorities guaranteeing a loan. Moreover, average risk weights are used in the calculations, so no account is taken of the distribution of the underlying risk weights, which may vary considerably across institutions. The calculations apply an average risk weight for residential real estate of 40 per cent, based on microdata from Statistics Denmark. The risk weights of individual institutions may deviate from this.

gage banks, and the relatively low estimated risk weights for mortgages, given the very low losses on mortgages over time. The capital floor may thus increase the risk-weighted exposures of the largest credit institutions in Denmark, although there may be grounds for the estimated risk weights being very low relative to the risk weights applying under the standardised approach.

Differences in structural conditions entail variations in actual credit risks

Setting a common floor for all credit institutions is difficult, as the security of the institutions' exposures varies widely. This may be attributable, inter alia, to different business models, but also to differences in structural factors across countries. For example, the share of defaulted housing loans varies considerably across countries. This may reflect cyclical factors, but also fundamental differences in national housing markets and associated legislation.

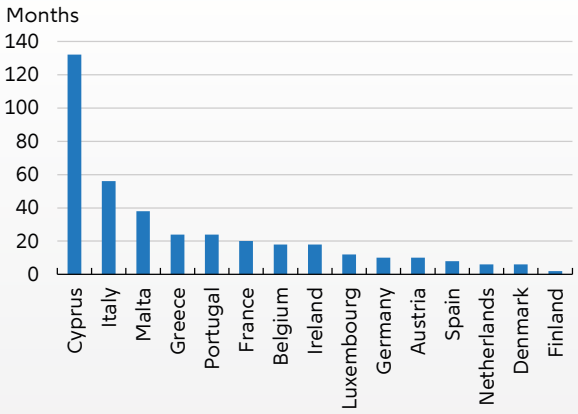
In the event of default on a housing loan, the credit institution's loss may be mitigated by a quick sale of the house. For instance, a quick enforced sale will reduce the period of potential non-maintenance of the house.

There is considerable cross-country variation in the duration of an enforced sale and hence in loss given default on housing loans. In e.g. Denmark, it typically takes around a half year from non-payment of an instalment on a mortgage until the residential real estate is sold, while the corresponding Italian process takes around 4½ years on average, cf. Chart 4.11.

There is also cross-country variation in whether or not there is personal liability – as in Denmark – for a housing loan.[10] Personal liability reduces the risk of losses for the institutions, since it gives the borrowers a stronger incentive to avoid default. Moreover, if the house is sold for less than the value of the debt, the credit institution may subsequently seek redress in the borrower's wealth and income.

The stability of the household income and hence the risk of the housing loan also depend on other factors such as the tax system and social safety net, as well as whether the household comprises one or two adults earning an income. The design of the capital floor should take into account fundamental factors related to credit risk; for example, the floor may be differentiated according to liability and default rules.

Duration of an enforced sale Chart 4.11



Note: Average period of an enforced sale, including finalisation of court cases, sale of real estate and distribution of proceeds to the creditors. For the euro area member states, the calculation is from 2007; for Denmark it is based on the current rules.

Source: ESRB (2015), *Report on residential real estate and financial stability in the EU* and LFGR.

10 Personal liability for housing loans exists in Denmark, Sweden, Norway, the Netherlands, Belgium, Germany, Austria, Italy, France, the UK, Ireland, the Czech Republic, Estonia, Lithuania, Latvia and Slovenia, but not in Finland, Greece, Poland, Hungary, Romania and Croatia, cf. ESRB (2015), *Report on residential real estate and financial stability in the EU*.

APPENDIX

IRB models and calculation of risk weights

Box 4.2
Continues

In 2008, several systemic credit institutions began to use Internal Ratings Based models, IRB models, for calculation of capital requirements for their credit exposures. Exposures are divided into various categories, e.g. sovereign, corporate and retail exposures. When an institution has obtained an IRB authorisation from the Danish Financial Supervisory Authority, IRB models must be used for all exposure categories, unless the institution has been exempted by the Danish Financial Supervisory Authority and allowed to use the standardised approach instead. For instance, exposures in unimportant business units and exposure categories may be exempted. The same applies to sovereign exposures to EU member states that are given a risk weight of zero under the standardised approach. The use of IRB models is monitored on an ongoing basis, and IRB institutions must apply to the Danish Financial Supervisory Authority for approval of significant changes to their IRB models.

The authorisation to use IRB models depends, inter alia, on the institutions using the models for internal risk management purposes as well. This will contribute to greater consistency between the institutions' decision-making processes and the regulatory capital requirements.

In IRB approaches, risk-weighted exposures are calculated for each exposure on the basis of a fixed formula, which can generally be written as[1]

Risk-weighted exposures =
*f(PD) * LGD * EAD * Maturity adjustment * 12.5 * 1.06*

The risk weight for each loan depends on, inter alia, the parameters PD, LGD and EAD. PD stands for Probability of Default on a loan in the coming year, while LGD stands for Loss Given Default. EAD stands for Exposure at Default. The institutions themselves estimate these parameters on the basis of e.g. internal information about the individual customers. The risk weights are influenced by various factors, including the quality of the institutions' customer base, which are reflected in the risk parameters. All else equal, the risk weights are lower, the better the customer base is. In other words, lower PD and LGD imply a lower risk weight.

LGD is included on a linear basis in the risk weight formula, meaning that the risk weight is doubled if LGD is doubled. The function for PD means that there is no linear relationship between PD and risk weight, cf. Chart 4.A.

The risk weight formula includes a correlation factor in f(PD). The correlation factor depends on the exposure category. For instance, there is a high correlation between large corporates and the economic development in general. Thus, the assumption is that the risk of default on their loans increases if the economy is hit by adverse shocks. Conversely, retail customers depend more on their own finances and are less correlated with general economic developments. In general, the correlation factor is therefore lower for retail exposures than for exposures to large corporates.[2] Corporates below a certain size – measured by annual revenues – are also assumed to be less dependent on macroeconomic developments than large corporates. This implies a reduction of the correlation factor for these corporates.

An institution may be authorised to use the Foundation IRB approach, F-IRB, or the Advanced IRB approach, A-IRB. Institutions using F-IRB approaches need only estimate PD themselves for corporate exposures. The other parameter values are statutory. For retail exposures, no distinction is made between A-IRB and F-IRB, meaning that the institutions themselves have to estimate all the parameters. Table 4.B provides an overview of Danish systemic credit institutions' use of the various approaches.

The calculation of risk weights also includes a maturity adjustment. Especially for exposures with long maturities and a low PD, there is a risk that the PD will increase over the life of the loan. The maturity adjustment for a given maturity is thus a decreasing function of the PD. No maturity adjustment is applied to retail exposures.

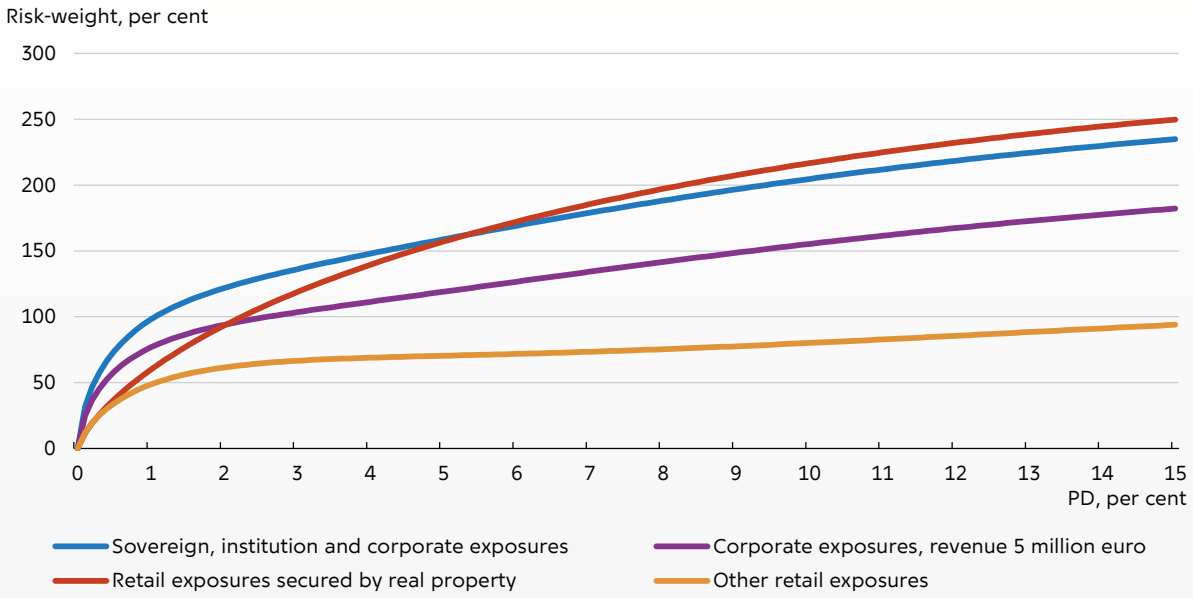
Moreover, the formula for risk-weighted exposures includes a factor of 12.5, calculated as the reciprocal value of 8 per cent. This is to ensure that institutions with a capital requirement of 8 per cent relative to risk-weighted exposures are funding a sufficient share of their assets out of equity to enable them to cover expected losses.

The factor of 1.06 is to ensure that the risk-weighted exposures of IRB institutions do not get too low compared with the institutions using the standardised approach, while still providing an incentive to use the IRB approach.

In addition, in January 2014, when the EU Capital Requirements Regulation, CRR, entered into force, a reduction was introduced for risk weights for exposures to small and medium-sized enterprises, SMEs. This reduction means that the institutions' risk-weighted exposures to SMEs are to be multiplied by a factor of 0.7619. This applies to both the standardised and IRB approaches.

1. For more detailed formulas, see Articles 153 and 154 of the Capital Requirements Regulation, CRR.
2. The risk weight formula uses a fixed correlation factor for retail exposures secured on real estate. This factor is generally higher than those for other retail exposures. The background is that the housing market depends on the general economic development to a higher degree.

Chart 4.A: Relationship between PD and risk weight



Anm.: A loss given default, LGD, of 45 and a maturity of 2.5 years have been applied.
Kilde: Own calculations.

Approach to calculation of credit risks by exposure category

Table 4.B

Groups	Sovereign exposures	Institution exposures	Corporate exposures	Retail exposures	Equity exposures
Danske Bank	Standard	A-IRB	A-IRB	IRB	Standard
Nordea Bank Danmark	Standard	F-IRB	A-IRB	IRB	Standard
Nykredit	Standard	Standard	F-IRB/A-IRB	IRB	Standard
Jyske Bank	Standard	Standard	A-IRB	IRB	Standard
Sydbank	Standard	Standard	F-IRB	IRB	Standard

Note: No distinction is made between A-IRB and F-IRB as regards retail exposures. In Nykredit Group, Nykredit Bank applies F-IRB, while Nykredit Realkredit and Totalkredit apply A-IRB.
Source: Credit institutions' risk reports.

5

CYBER RISK AND RESILIENCE

CYBER RISK AS A THREAT TO FINANCIAL STABILITY

The financial sector is dependent on complex IT systems in order for the financial institutions to conduct their business. At the same time, the institutions are interconnected through the cross-sector financial infrastructure of shared data centres, payment and settlement systems. A stable financial system relies on trust that book-entry of transactions are correct and are kept confidential, that settlement of financial transactions takes place in a timely manner and that the customer oriented systems are safe and accessible. In Denmark, the Centre for Cyber Security assesses the risk of cybercrime against authorities and private firms to be very high.[1] For the financial sector, repeated cyberattacks may weaken confidence in the financial system by compromising the above functions, and an extensive cyberattack could potentially affect the whole or substantial parts of the sector. Hence, the risk of cyberattacks in the financial system is of a systemic nature – i.e. it is a potential threat to financial stability.

The Systemic Risk Council focused on cyber risk in the financial sector at its meeting in December 2015. The Council subsequently held a seminar on cyber resilience in the financial sector for a wide range of sector representatives. At this seminar it was agreed to establish a sector forum for operational resilience, including cyber resilience. The forum will support knowledge-sharing and collaboration across institutions.

CYBER RISK HAS SPECIAL CHARACTERISTICS

Cyber risk is an operational risk. Operational risk is the overall term used for financial institutions' risk of losses due to inexpedient or inadequate internal processes, human errors and actions, system errors or external events. Operational incidents include system downtime due to e.g. severed cables, power outages, defective IT components, software update errors, etc. Financial sector participants, as well as owners and operators of payment and settlement systems, protect themselves against operational risk by preparing contingency plans and procedures, testing their preparedness and setting up second sites.[2]

The characteristics of cyber risk differ from those of the more traditional operational incidents, cf. Box 5.1. For example, a cyberattack may affect the production systems and the second site at the same time. This could mean that the entire system, including the critical backup systems, shuts down. Furthermore, cyberattacks may be more persistent and more difficult to detect than ordinary IT failures. Due to the interconnectedness of the infrastructure, cyberattacks may come through many entry points, such as participants, other systems and service providers.

1 Threat assessment unit of the Centre for Cyber Security, The cyber threat against Denmark, January 2016.

2 This means a secondary data centre duplicating all critical systems. If an operational incident occurs, production switches to the secondary data centre, where it can be resumed within a short space of time.

Special characteristics of cyber risk Box 5.1

- *Duration*: A cyberattack can be of considerably longer duration than more traditional operational incidents. The reason is that there is a perpetrator who can affect the duration of the attack.
- *Propagation*: Cyberattacks may spread between financial sector participants via the complex network of IT systems.
- *Variation*: Cyberattacks are developed and refined on a continuous basis, while traditional operational incidents are of a more static nature. Hence, a complicating factor is that new cyberattacks may differ from previous attacks.
- *Detection*: It may be difficult to detect IT system intruders – especially if they only view the information and do not compromise data.

CONSEQUENCES OF A CYBERATTACK

Cyber risk is the risk of external electronic attacks aimed at IT activities, including computers, servers, systems, networks, services, etc. For a cyberattack to have devastating consequences, the perpetrator must be able to exploit the vulnerability of IT systems, internal procedures or employees, cf. Chart 5.1.

Cyberattack perpetrators may be hackers, political groups, other nations, competitors or a collaboration partner who has been infiltrated by a third party. The motives for a cyberattack range from financial gain to the wish to create economic or political instability or to gain access to confidential knowledge, or in some cases it is simply seen as a challenge.

A cyberattack may have the following direct effects on the IT systems of financial institutions and payment and settlement systems:

- *Accessibility:* Websites, online banking and critical business systems for settlement of transactions are disrupted, and time-critical payments may be delayed.
- *Confidentiality:* Confidential data may be shared with unauthorised persons or disclosed to the public.
- *Integrity:* Data may be compromised. In the worst case, this could lead to uncertainty about the correct recipients or senders of transactions or the rightful ownership of assets.

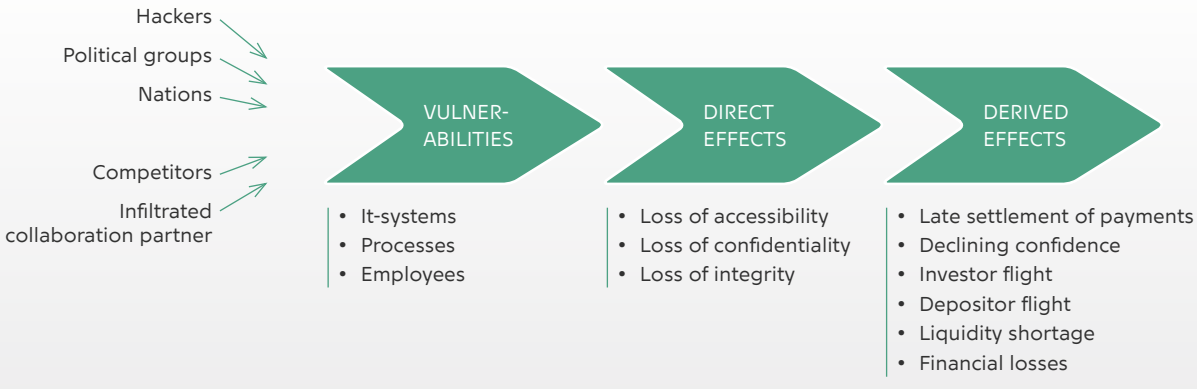
A cyberattack that hits a large financial institution or critical payment and settlement systems and that affects accessibility, confidentiality or integrity may reduce confidence, which in turn may lead to investor or depositor flight. Derived effects of a cyberattack could potentially jeopardise financial stability.

Two elements are essential when it comes to strengthening the resilience of the financial sector to cyber threats. Firstly, each individual financial institution must be cyber resilient. Secondly, the financial system overall must be cyber resilient. These two aspects will be elaborated on in the following.

THE CYBER RESILIENCE OF THE INDIVIDUAL FINANCIAL SECTOR PARTICIPANT

The financial sector's dependence on complex IT systems places heavy demands on sector partici-

Cyberattacks and potential derived effects Chart 5.1



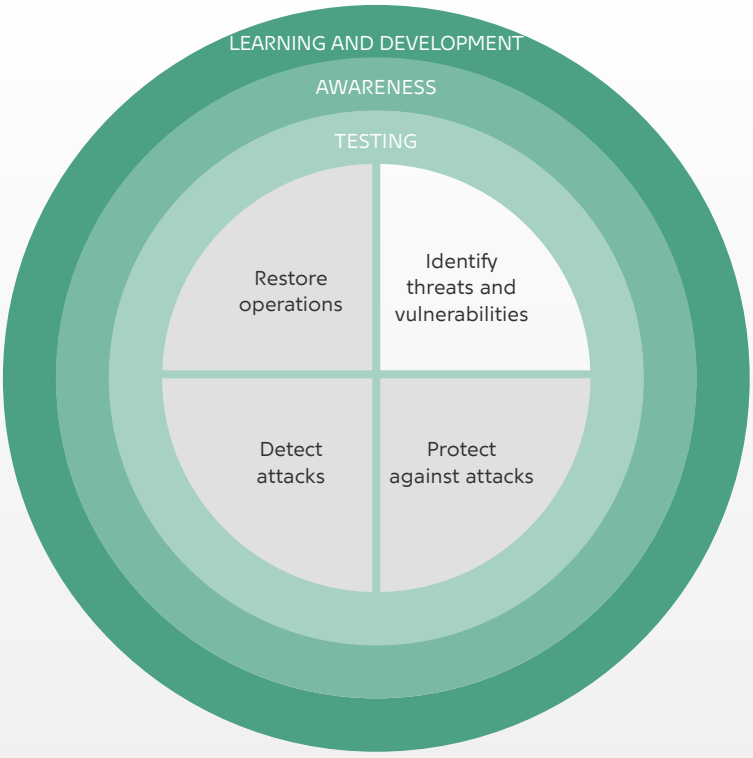
pants in terms of management of operational risk, including external threats such as cyber risk. It is the responsibility of each individual participant to have effective defences against the risks faced. The effort to ensure cyber resilience should be anchored at the top management level and should comprise IT systems, processes and employees within the organisation.

Robust cyber contingency measures include the ability to protect the organisation against and detect attacks, and to ensure speedy and correct resumption of operations after any attack, cf. Chart 5.2. This means that threats and vulnerabilities must be identified and assessed so that resources and countermeasures can be targeted at the significant risks. Protection against attacks requires strong IT and security controls, including access controls, restriction of rights and screening/background checks of employees. Attacks are detected via continuous monitoring of system activities relating to employees, processes and technology for anomalous behaviour. In addition, the systems must be robust and have sufficient capacity for core business system operations to be resumed rapidly and safely with correct data in the event of an attack.

A key element of the work to review risks is to conduct regular system tests. These include vulnerability scanning and tests to simulate real cyberattacks, such as penetration tests, but also testing of procedures to restore operations and of crisis communication. The tests should be based on extreme, but plausible scenarios, and it is important to stay abreast of current cyber threats, e.g. by participating in relevant knowledge-sharing and collaboration forums. To strengthen learning and development, technological advances should be monitored actively in relation to both threats and measures to counter them.

Aspects and elements of cyber preparedness

Chart 5.2



Note: The chart illustrates aspects and elements included in a consultative report from the Committee on Payments and Market Infrastructures (CPMI) and the Board of the International Organization of Securities Commissions (IOSCO). The report is aimed at systemically important payment and settlement systems, but the guidance is relevant for all firms that are dependent on complex IT systems, including banks, pension and insurance companies, etc.

Source: CPMI-IOSCO, *Guidance on cyber resilience for financial market infrastructures*, consultative report, November 2015

The operational resilience of the financial sector, including cyber resilience, is subject to regulatory control. The Danish Financial Supervisory Authority supervises the management of operational risk in the financial sector, e.g. by conducting IT inspections to assess whether participants' IT and security controls meet the applicable requirements and standards. As part of the inspections, "maturity assessments" are performed to map the respondents' ability to identify and protect themselves against cyberattacks.

Danmarks Nationalbank oversees that the Danish payment and settlement systems comply with international standards for management of operational risk, including cyber risk. This is done by gathering information about operational system incidents on an ongoing basis, including the measures taken to contain any consequences of such incidents. The results of the systems' test programmes are reviewed at oversight meetings between Danmarks Nationalbank and the system owners. The oversight activities are reported on in an annual oversight publication.[3]

In order to gain a comprehensive view of cyber resilience, Danmarks Nationalbank and the Danish Financial Supervisory Authority have decided jointly to conduct a stock-taking survey of the cyber preparedness of the financial sector. This survey is expected to be conducted in 2016.

SYSTEM CYBER RESILIENCE

Operational incidents, including cyberattacks, may spread across institutions and systems via technical and financial dependencies. The interconnectedness of the financial sector means that participants have a shared responsibility for handling mutual risk in a safe and efficient manner. For this reason, a sector forum has been established with the participation of key players and authorities, including the largest banks and mortgage banks, payment and settlement systems, data centres, industry associations, etc., cf. Box 5.2. Danmarks Nationalbank heads and acts as secretariat for the sector forum.

The sector forum is to map the dependencies and mutual operational risks existing across the sector. Initially this will mean preparing an overview of the individual participants in the financial network as a basis for analysing potential vulnerabilities. In addition, Danmarks Nationalbank expects the sector forum to assume a coordinator role, thereby supporting effective contingency measures and the possibility of conducting cross-sector tests. Finally, the forum is to create an overall framework for knowledge-sharing, including sharing of experience in relation to threats, risks and countermeasures, and briefing on relevant information gained in other forums.

Participants in the sector forum Box 5.2

- *Banks and mortgage banks:* Danske Bank, DLR Kredit, Jyske Bank, Nordea, Nykredit, Sydbank
- *Payment and settlement systems:* Nets, VP Securities
- *Data centres:* Bankdata, BEC, JN Data, SDC
- *Industry associations:* Danish Bankers Association, Danish Insurance Association, Association of Danish Mortgage Banks
- *Authorities:* Centre for Cyber Security, Ministry of Business and Growth, Danish Financial Supervisory Authority, Danmarks Nationalbank
- *Others:* The Financial Stability Company, Nasdaq

3 See e.g. Danmarks Nationalbank, *Oversight of the Financial Infrastructure in Denmark*, 2016, May.

APPENDIX

APPENDIX 1: POPULATION IN THE REPORT

The population in the report comprises the Danish mortgage banks and the systemic and non-systemic banks grouped by the Danish Financial Supervisory Authority in 2016 as groups 1 and 2, cf. Table B1.1. Unlike the Danish Financial Supervisory Authority's group 2, Saxo Bank has been omitted from the population due to its business model. The grouping also applies back in time.

This chapter uses the term credit institution when the analysis comprises both the bank and mortgage bank activities of the business. The term systemic credit institutions comprises the six institutions that have been selected as systemically important financial institutions, SIFIs.

Banks and mortgage banks in the population by total assets as at 31 December 2015 Table B1.1

	Kr. million
Systemic banks	
Danske Bank	2,037,188
Nordea Bank Danmark	478,490
Jyske Bank	309,928
Nykredit Bank	173,532
Sydbank	144,880
Systemic banks, total	**3,144,019**
Non-systemic banks	
Spar Nord Bank	77,498
Arbejdernes Landsbank	41,978
Vestjysk Bank	21,114
Ringkjøbing Landbobank	22,317
Sparekassen Kronjylland	19,417
Nordjyske Bank	18,660
Den Jyske Sparekasse	15,092
Sparekassen Sjælland	14,142
Jutlander Bank	15,031
Lån & Spar Bank	15,511
Sparekassen Vendsyssel	13,689
Non-systemic banks, total	**274,451**

	Kr. million
Systemic credit institutions	
Danske Bank (including Realkredit Danmark)	3,016,698
Nordea Bank Danmark (including Nordea kredit)	808,057
Jyske Bank (including BRFkredit)	543,399
Nykredit Realkredit (including Nykredit Bank)	1,383,789
Sydbank	142,742
DLR Kredit	148,442
Systemic credit institutions, total	**5,894,684**
Mortgage banks	
Nykredit Realkredit	1,282,458
Realkredit Danmark	836,593
Totalkredit	651,517
Nordea Kredit	437,867
BRFkredit	269,975
DLR Kredit	148,442
LR Realkredit	20,318
Mortgage banks, total	**3,647,170**

Note: Total assets for systemic banks, non-systemic banks and mortgage banks are stated at solo level. Total assets for systemic credit institutions are at a group level.
Source: Annual reports.

APPENDIX 2: SCENARIOS OF DANMARKS NATIONALBANK'S ACCOUNTS-BASED STRESS TEST

Scenarios, selected key variables Table B2.1

	2016	2017	2018
Baseline scenario			
GDP, per cent year-on-year	1.3	1.8	1.8
Private consumption, per cent year-on-year	1.8	2.0	2.0
Export market growth, per cent year-on-year	3.7	4.5	4.3
Gross unemployment rate, per cent	3.8	3.7	3.6
House prices, per cent year-on-year	3.5	3.1	3.1
Low Growth			
GDP, per cent year-on-year	1.0	-0.6	0.9
Private consumption, per cent year-on-year	1.4	-1.6	-0.3
Export market growth, per cent year-on-year	3.7	4.5	4.3
Gross unemployment rate, per cent	3.9	4.7	5.4
House prices, per cent year-on-year	2.8	-5.3	-1.7
Severe recession			
GDP, per cent year-on-year	0.8	-4.4	-0.5
Private consumption, per cent year-on-year	1.3	-3.7	-1.3
Export market growth, per cent year-on-year	2.3	-8.1	3.4
Gross unemployment rate, per cent	4.0	6.4	9.3
House prices, per cent year-on-year	2.3	-11.8	-6.9

Note: Annual averages. Gross unemployment is expressed as a ratio of the labour force.