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FINANCIAL STABILITY – 2ND HALF 2022

Turbulent times call for a focus on risk management

Large fluctuations in financial markets

The financial markets are characterised by high inflation, higher interest rates and considerable volatility. This has deteriorated market liquidity and requires a stronger focus on liquidity management throughout the financial sector.

Expectation of higher credit losses in the coming time

Higher interest rates and inflation, as well as the prevalence of risky loan types, increase the risk of defaulting loans. Combined with declining property prices, this will lead to credit losses in banks.

Severe recession will challenge some institutions' excess capital adequacy

Danmarks Nationalbank's stress test shows that some systemically important credit institutions will come close to breaching the capital buffer requirements in a severe recession. The weakened economic outlook underlines the need for prudence in the institutions' capital planning.

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FINANCIAL MARKETS

Prospects of reduced economic growth and higher inflation and interest rates

After a long period of low interest rates and solid global economic growth, there are signs of an economic dampening, both globally and in Denmark. Supply chain disruptions, rising energy prices and demand pressures have led to high inflation, prompting central banks worldwide to tighten monetary policy.

Financial stress across submarkets

Financial markets have seen increased stress levels. Interest rate hikes and increased volatility have caused extensive losses in the bond markets and have increased collateral requirements in derivatives markets. This was felt, in particular, in the UK in September, where parts of the British pension sector faced major challenges. Danish pension companies have a sufficient amount of highly liquid assets to handle a larger interest rate hike. It is less likely that we will see a similar scenario in the Danish pension sector.

HOUSING CREDIT

Declining house prices increase risk of technical insolvency

With the expected decline in house prices in Danmarks Nationalbank's latest projection, one in ten homeowners who bought their home since the beginning of 2021 will end up with a housing debt that exceeds the value of their home in 2023. First-time buyers are at greatest risk of becoming technically insolvent.

Risky loan types are on the rise

More homeowners are taking out variable-rate mortgage loans, and an increasing proportion of those are with deferred amortisation. Highly indebted homeowners with this type of loan are particularly vulnerable to house price falls and higher interest rates. It is therefore of the essence that these homeowners have a robust economy to withstand interest rate increases. In this context, it is important that the credit institutions continue to perform thorough credit evaluations.

Rising costs challenge some homeowners

Low-income homeowners are particularly challenged by higher heating costs and interest expenses, but lending to this segment represents a small part of total lending. Rising prices of other consumer goods, including electricity, are adding further to homeowners' expenses. This makes homeowners vulnerable to unemployment and increases the risk of loan defaults. Combined with declining house prices, more loan defaults will lead to credit losses for the banks.

CORPORATE CREDIT

Small businesses less resilient and more exposed to rising prices and interest rates

As a result of rising consumer prices, households are expected to reduce their consumption. This can put pressure on cyclically sensitive businesses, which are already struggling with rising costs. Particularly at risk are small businesses, which are generally less robust. This will likely result in losses for medium-sized banks that have pronounced exposures to this segment.

Letting businesses have caused significant losses in the past

Just as it was the case in the period leading up to the financial crisis, credit institutions have pronounced exposures to letting businesses whose main activity is the letting of residential and business properties. However, lending growth has not reached the same high level, and letting businesses appear more resilient to losses. However, higher interest rates and falling earnings will significantly diminish the debt service capacity of some of them.

LIQUIDITY AND FUNDING

Raising liquidity is more expensive

Currently, banks have reasonable liquidity buffers, but raising liquidity via the market has become more expensive. This follows a long period of liquidity being readily available and with lower prices. The situation in the financial markets and the real economy shows that the demand for liquidity from banks' customers can change rapidly. The changed market conditions for obtaining liquidity mean that banks now need to be more prepared for increasing liquidity needs and loan demand from their customers than they used to.

Pension and life insurance companies need to focus on number of repo counterparties
Due to volatile markets and higher interest rates, pension and life insurance companies have seen increasing needs for liquidity to pay variation margins on their derivatives contracts. They have only limited cash holdings, and some have only one or a few repo counterparties to provide liquidity. It is important that these companies focus on securing a sufficient number of repo counterparties.

EARNINGS

Higher interest rates increase net interest income
The profit before tax decreased for systemic credit institutions in 2022. Negative value adjustments contributed to the decline. On the other hand, there are early signs of increases in core earnings, resulting from, among other things, higher net interest income. Higher interest rates are expected to further increase net interest income, strengthening the institutions' resilience against credit losses.

Weakened macroeconomic conditions may increase impairment charges
Low impairment charges continue to support earnings. Higher interest rates, high inflation and the prospect of an economic dampening are expected to worsen some customers' debt service capacity, creating a risk that institutions will have to recognise further impairment charges. Part of the effect may already be reflected in existing impairment charges, including management estimates.

CAPITAL AND STRESS TESTS

Important for credit institutions to ensure sufficient excess capital adequacy relative to total MREL
The maturity of senior debt over the coming quarters will reduce the banks' excess capital adequacy relative to the MREL. It is problematic if, in order to meet the requirement, banks depend on market access within a short period of time. This should be avoided by building up sufficient excess capital relative to the requirement and ensuring a sufficiently long maturity profile on senior issuances.

Severe recession will challenge some institutions' excess capital adequacy
The weakened economic outlook requires banks to exercise further caution in their capital planning. In Danmarks Nationalbank's stress test, some systemic credit institutions come close to breaching the capital buffer requirements in a severe recession. They therefore need their current excess capital to withstand stress. The uncertainties surrounding the European Commission's banking package underline the need for banks to exercise further caution.

CLIMATE

Institutions must address climate-related risks
Climate change and the consequences of the green transition have the potential to affect financial stability. Climate-related financial risks need to be addressed in line with other risks. Therefore, institutions must develop capacity to identify and analyse possible risks and their potential consequences.

Homeowners will often be able to improve their energy label with profitable renovations
The EU Commission has proposed new energy renovations for the least energy efficient properties. In Denmark, homeowners will often be able to improve their energy label by means of profitable renovations. Homeowners' focus on housing energy consumption may lead to energy efficiency becoming a more integrated part of housing market pricing.

Large fluctuations in financial markets

Prospects of global economic dampening

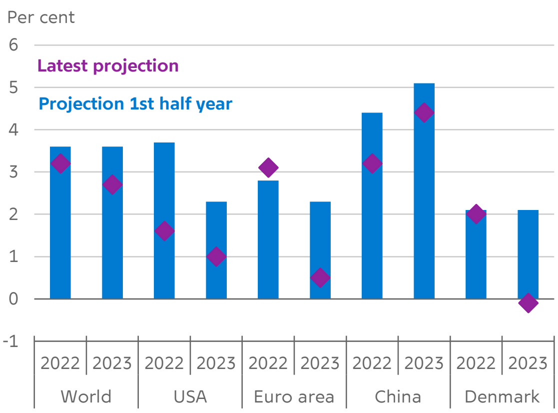
After a long period of low interest rates and sizeable economic growth, there are signs of an economic dampening, both globally and in Denmark. Accordingly, the growth outlook has been revised downwards in the latest forecasts from the International Monetary Fund (the IMF) and Danmarks Nationalbank, see chart 1. In Denmark, the economic dampening comes after a strong economic recovery last year, which sent Denmark into an economic boom.

High inflation has weakened consumers' purchasing power

Inflation has been rising sharply for much of 2021 and throughout 2022, and core inflation[1] in the euro area and Denmark has picked up in the past year, see chart 2. This shows that price pressures are driven not only by higher energy and food prices, as a consequence of supply disruptions in the wake of the pandemic and the war in Ukraine, but also by strong demand pressures. The European Central Bank (ECB) expects inflation in the euro area to decline in 2023 and to fall to levels around the inflation target of 2 per cent in 2024. Wages in Europe have not risen at the same rate as inflation, which has reduced the purchasing power of consumers.

Growth prospects have been revised downwards in global economy and in Denmark

Chart 1

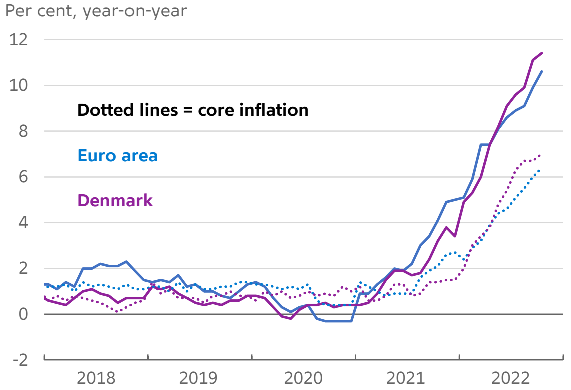


Note: The IMF's estimate for the world is based on exchange rates. The IMF's estimates are from April and October 2022. GDP growth in Denmark is based on Danmarks Nationalbank's projections from March and September 2022.
Source: IMF and Danmarks Nationalbank.

1 For the euro area and Denmark, core inflation is calculated as consumer prices excluding energy and unprocessed food.

Inflation has increased to a very high level

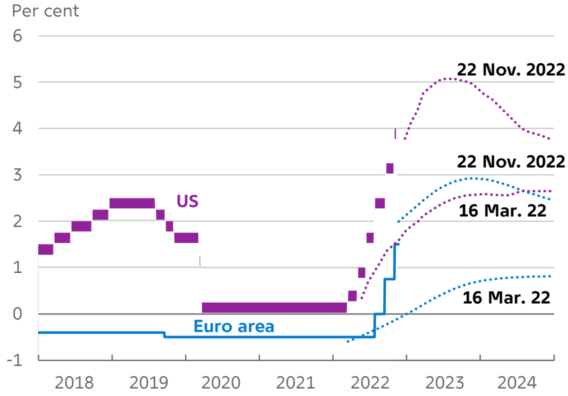
Chart 2



Note: Development in inflation and core inflation in the euro area and Denmark. The most recent observations are from 1 October 2022.
Source: Macrobond.

Prospect of further interest rate increases

Chart 3



Note: Dashed lines indicate market-implicit expectations for money market interest rates in the USA and the euro area on the indicated date.
Source: Macrobond, Scanrate Rio and Danmarks Nationalbank.

Central banks are tightening monetary policy considerably

The high inflation rate has led central banks around the world to significantly increase their key interest rates. The tightening of monetary policy has resulted in major movements in financial markets. In addition, the ECB has tightened monetary policy by halting net purchases of government bonds under their asset purchase programmes. Market participants expect the Federal Reserve (the Fed) and ECB key interest rates to peak at 5.1 per cent in August 2023 and 2.9 per cent in October 2023, respectively, see chart 3, after which monetary policy is gradually expected to ease again.

Financial stress across markets

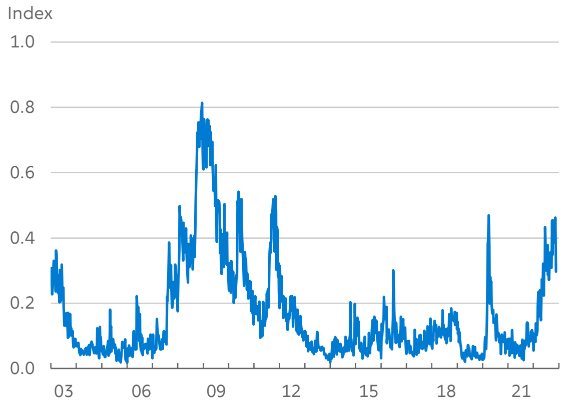
Financial markets have seen increased stress levels. Danmarks Nationalbank's financial stress indicator for Denmark has thus been increasing in 2022 and was on a par with the first corona lockdown in certain periods, but lower than during the financial crisis, see chart 4. The increased stress has been evident across submarkets, where substantial equity and bond market losses have gone hand in hand with high volatility in interest rate, currency and energy markets volatility.

Sharp increases in interest rates and volatility resulted in large bond market losses

Government bonds in particular have previously served as a safe haven in situations of high market volatility and falling prices on equity markets. However, increased interest rates have led to heavy losses

Market stress has been on par with first corona lockdown

Chart 4



Note: The financial stress indicator for Denmark aggregates the level of stress in five key financial submarkets. The stress level in each submarket is measured using three market indicators, each of which captures market stress elements. The calculation of the final stress indicator takes account of the fact that simultaneous stress in several submarkets is a greater challenge to the financial system than periods of stress in individual submarkets. See, moreover, Danmarks Nationalbank, Financial Stability, 2nd half 2014. The most recent observations are from 20 November 2022.
Source: Bloomberg, Nordea Analytics and own calculations.

on government bonds, where the price of a Danish 10-year government bond up to November had fallen by about 20 per cent since the turn of the year. The large fluctuations in bond prices, see chart 5, and the resulting losses have coincided with volatility in other markets. This was felt, in particular, in the UK, where the price of government bonds fell sharply following the UK government's announcement of fiscal easing on 23 September.

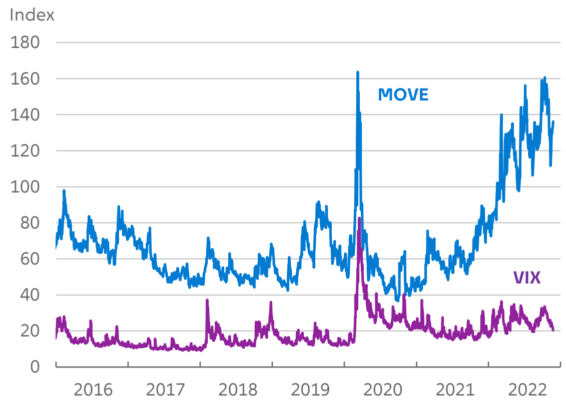
Increased collateral requirements in derivatives markets

The large movements across assets have increased collateral requirements in the derivatives markets for interest rates, currency and commodities. This has amplified the liquidity need of market participants in the derivatives markets, which has increased the demand for loan facilities in banks, as explained in the section on liquidity and funding.

In the UK, the increase in interest rates following the monetary policy interest rate hike and the announcement of possible fiscal easing posed major challenges for a subset of the UK pension sector, which experienced variation margin calls on interest rate derivatives, see box 1 and losses on underlying assets in their repo financing[2]. This spurred concern in the markets over a potential fire sale of bonds, where companies sell off bonds to obtain liquidity. Fears over a negative price spiral prompted the Bank of England to intervene in the market to prevent "severe disruption of core funding markets and consequent widespread financial instability".[3]

Danish pension and life insurance companies have enough highly liquid assets to meet margin calls on their interest rate derivatives to cover an interest rate increase of at least 300 basis points, which makes a similar scenario less likely to happen in Denmark[4]. The pension sector's ability to meet margin calls presupposes that the companies have enough

Bond market volatility is high Chart 5



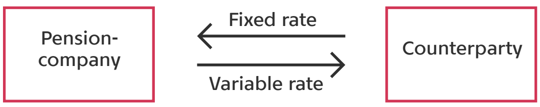
Note: Implied volatility for S&P 500 stock index (CBOE Market Volatility Index) and US Treasury bonds (ICE BofAML MOVE index). The most recent observations are from 24 November 2022.
Source: Macrobond.

How an interest rate swap works Box 1

A typical interest rate swap is a contract in which two parties swap payment flows. One party pays a variable rate, while the other party pays a fixed rate. The variable rate depends on a predetermined reference rate, and the fixed rate is determined at the time of conclusion.

The market value of the interest rate swap at the conclusion of the contract is usually zero. If the variable rate increases, the value of the contract decreases for the recipient of the fixed rate. This means that the market value becomes negative for the recipient of the fixed rate, and therefore collateral for the movement (variation margin) is required with the counterparty, which increases the liquidity need for the recipient of the fixed rate.

Pension companies typically use interest rate swaps, where they receive the fixed rate in exchange for paying the variable rate.



2 A repo agreement, or repurchase agreement, is a transaction in which a party sells an asset to another party, and at the same time, the parties make an agreement to repurchase the asset at a later date at a set price.

3 See letter from the Governor of the Bank of England, Sir Jon Cunliffe, to the Parliament of 5 October 2022 (*link*).

4 See Danmarks Nationalbank, The pension sector's alternative investments, *Danmarks Nationalbank Analysis*, No. 22, September 2021 (*link*).

repo counterparties, as described in the section on liquidity and funding.[5]

State guarantee furnished to support liquidity of energy companies

Substantial increases and fluctuations in energy prices in 2022 have also increased margin requirements for energy companies. As in a number of other countries, the Danish state has furnished a state guarantee to support energy and gas companies' liquidity. The guarantee of kr. 125 billion can be used by an electricity or gas company's bank if it provides liquidity to the company. In that case, the state assumes 80 per cent of the risk.

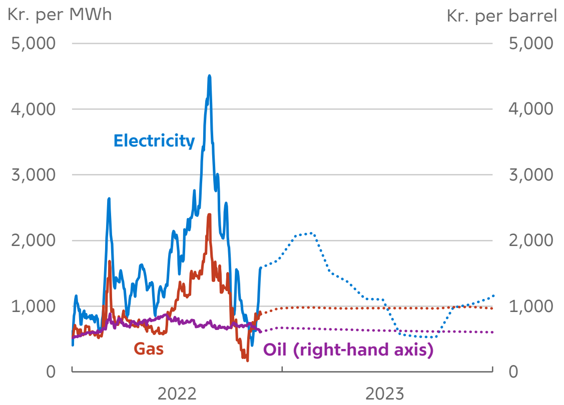
Energy prices were at their highest in August, but have since fallen, see chart 6. This happened at the same time as European gas storage facilities were filling up and consumers adapted their consumption. However, prices remain at a significantly higher level than before 2021, and market participants expect energy prices to remain high in the coming years.

Falling prices of Danish mortgage bonds

Mortgage rates have increased sharply in 2022. The increase is partly explained by the tightening of monetary policy in the euro area. The option-adjusted spread to Danish government bonds has also widened, see chart 7. The option-adjusted spread is a measure of the credit and liquidity premium on callable bonds.[6] The increase in the option-adjusted spread has followed in the wake of a significant increase in the duration of callable mortgage bonds, just as there have been greater fluctuations in interest rates[7]. In spite of deteriorating market liquidity, mortgage credit institutions have been issuing throughout the period.

Highly volatile energy markets

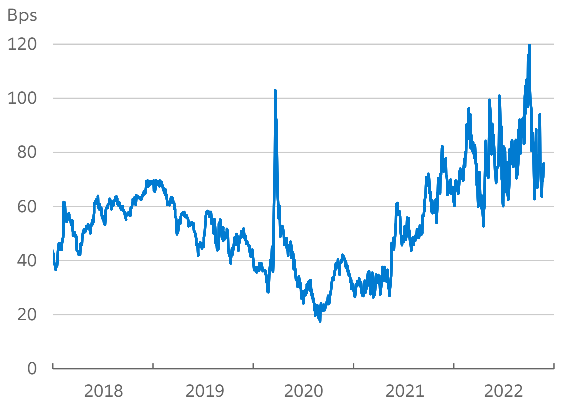
Chart 6



Note: The electricity price refers to the average Nordpool price measured as a 14-day moving average. The gas price is the price of TTF natural gas, and the oil price is the price of a barrel of Brent oil. Dotted lines indicate futures prices. The most recent observations are from 24 November 2022.
Source: Macrobond.

Substantial fluctuations in mortgage bond yield spread

Chart 7



Note: The OAS spread for Nykredit's total index to a Danish ten-year government bond. The most recent observation is from 24 November 2022.
Source: Nykredit Markets.

5 For a further understanding of the pension companies' liquidity need and use of interest rate derivatives, see Danmarks Nationalbank, Pension companies will have large liquidity needs if interest rates rise, *Danmarks Nationalbank Analysis,* No. 23, November 2019 (*link*).

6 The Danish bond market differs from the bond markets of other comparable countries by the wide spread use of callable mortgage bonds. These bonds have the special feature that they can always be redeemed at a rate of 100 (par). This option has implications for the bonds' interest rate risk (duration), which increases in case of interest rate increases.

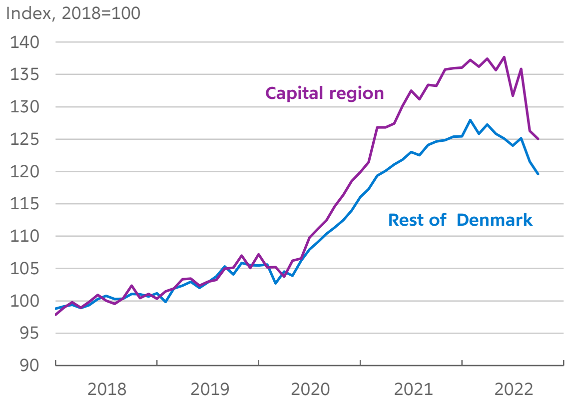
7 Duration is an expression of the interest rate risk of the bonds, i.e. the change in price resulting from a change in the yield to maturity.

Higher heating costs and interest rates will challenge some homeowners

Prospect of continued declines in house prices
Higher interest rates and lower real wages are impacting the housing market, where activity has slowed down significantly. This has led to a fall in house prices, especially in the Greater Copenhagen area, see chart 8. The fall follows two years of high activity levels and major house price increases.

The prices are predicted to fall even further in the coming time. In Danmarks Nationalbank's latest projection house prices are expected to decrease by 5.6 per cent in 2023, corresponding to a price decline of approx. 9 per cent from the peak in the 2nd quarter of 2022. There is considerable uncertainty about house price developments, and house price drops can be more severe.[8]

House prices have gone down in the Greater Copenhagen area in particular Chart 8



Note: Seasonally adjusted house prices for single-family houses from Boligsiden. The most recent observations are from October 2022.
Source: Boligsiden and own calculations.

Declining house prices increase risk of technical insolvency
There are no signs that homeowners have been extracting home equity extensively through borrowing following the property price hikes seen in recent years. This has reduced the risk of technical insolvency for homeowners who bought their homes several years ago. The risk is greatest for highly mortgaged

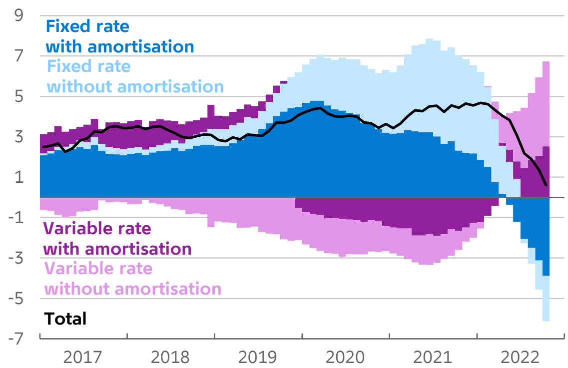
8 Danmarks Nationalbank, The pressure on the economy should be eased, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, No. 11, September 2022.

homeowners who bought their property recently. With the expected decline in house prices in Danmarks Nationalbank's latest projection, one in ten homeowners who bought a home after the beginning of 2021 will end up with a housing debt that exceeds the value of their home at the end of 2023. First-time buyers will be hit relatively harder, with one in seven (14 per cent) becoming technically insolvent.

Highly mortgaged homeowners who have taken out variable-rate mortgages with deferred amortisation are particularly vulnerable to interest rate hikes and house price declines. This is first and foremost due to the fact that they are not paying off their debt. Additionally, homeowners with variable-rate loans do not have the same home equity protection as homeowners with fixed-rate loans, since those with variable-rate loans cannot utilise the declining market value of the debt when interest rates rise.

Increase in variable-rate mortgage loans with deferred amortisation

Chart 9



Note: Growth contribution to annual growth in total mortgage lending calculated at nominal value. The most recent observations are from October 2022.
Source: Danmarks Nationalbank.

Growing prevalence of variable-rate loans with deferred amortisation

An increasing number of households are taking out variable-rate mortgage loans, of which an increasing proportion is with deferred amortisation, see chart 9. The development has led the Systemic Risk Council to issue an observation that, if interest rates rise, homeowners risk significantly higher debt service costs. This would result in substantially reduced disposable incomes and an increased risk of loan default.[9]

The increase in variable-rate mortgage loans is mainly due to interest rate increases, where long-term interest rates have risen more than short-term rates. Among other things, this has led to the refinancing of mortgage loans worth kr. 173 billion in the first three quarters of the year, of which around 40 per cent have been converted from fixed to variable interest rates.

It is crucial that homeowners who opt for variable interest rates and deferred amortisation are sufficiently bolstered to withstand interest rate increases. It is important that banks continue to perform a thorough credit rating.

Households with interest rate fixing in 2023 can expect a significant increase in expenditure

A number of homeowners with variable-rate mortgage loans are looking at an interest rate increase in connection with the fixing of new interest rates in 2023. Combined with rising heating costs, this may lead to a significant increase in costs for the individual homeowner. Danmarks Nationalbank has calculated how households with variable mortgage loans are affected by the combination of higher heating and interest costs. The calculation is based on the 220,000 households for whom a new and higher interest rate on their mortgage debt will be fixed in 2023. This corresponds to approximately 40 per cent of all variable-rate mortgage debt and 20 per cent of the total mortgage debt of 1,697 billion kr. in the 3rd quarter of 2022.

Heating and debt service[10] costs for these households will increase from 18 to 27 per cent of disposable income when the higher interest rates and heating prices as of October 2022 is taken into account, see chart 11, left. The change is calculated as the difference between costs relative to disposable

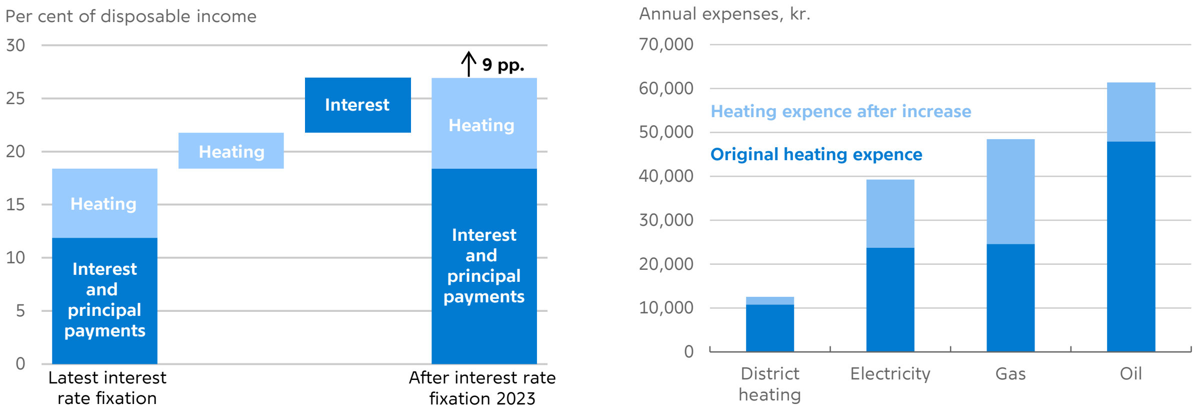
9 The Systemic Risk Council, The growing prevalence of variable-rate mortgages with deferred amortisation contributes to the build-up of risk, *Observation*, September 2022.

10 Debt servicing includes the payment of interest, contributions and repayments on loans.

Homeowners with variable-rate mortgage loans are looking at significant increases in costs due to higher heating prices and interest rates

Chart 10

Change in heating and debt service costs | **Change in home heating costs**



Note: Left-hand chart: Development in average heating costs and debt service relative to disposable income due to higher heating prices and interest rates, see box 3. The focus is on households with variable-rate loans for which the interest rate is due to be fixed in 2023. The chart has been calculated on the basis of the latest interest rate fixing and projected to the next interest rate fixing in 2023. Right-hand chart: Average cost of residential heating broken down by different heat sources, calculated as the median cost. The cost has been calculated on the basis of heating prices at the latest interest rate fixing and October 2022.
Source: Danmarks Nationalbank, Statistics Denmark and own calculations.

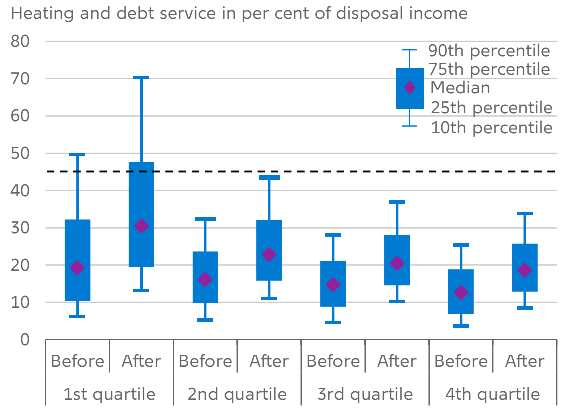
income at the last interest rate fixing and the upcoming interest rate fixing in 2023.[11] It does not take into account that many households will reduce their heat consumption. Moreover, the calculation does not take account of price increases for other consumer goods, including electricity. The analysis is described in detail in box 2.

The effect is significantly greater for households with deferred-amortisation loans, as they only pay interest, and any increase in interest rates will be reflected in full in their debt service payments.[12] As a rule, however, homeowners with variable-rate loans with deferred amortisation have a lower debt service ratio than homeowners with other types of loans.

Higher heating costs and debt service account for 3 and 5 percentage points, respectively, of the

Especially low-income homeowners will find it harder to service their debt in a situation with rising interest expenses and heating costs

Chart 11



Note: Heating costs and debt service as a percentage of disposable income before and after increase in interest and heating costs by income quartiles. The income quartiles are defined by households with interest rate fixing in 2023. The dotted line indicates when the percentage of total heating and debt service costs relative to disposable income is considered high.
Source: Danmarks Nationalbank, Statistics Denmark and own calculations.

11 This means that some homeowners who have fixed their interest rate during 2022 have already felt the impact of both higher heating prices and interest rates to some degree.

12 See Danmarks Nationalbank, Rising interest rates and prices can challenge banks' customers, *Danmarks Nationalbank Analysis (Financial Stability)*, No. 7, June 2022.

increase. This corresponds to an average annual increase in heating costs and debt service of kr. 12,000 and kr. 23,000, respectively. Households with gas heating, in particular, will be affected by heating bill increases, see chart 10, right. For these households, the average annual expense will increase by kr. 24,000.

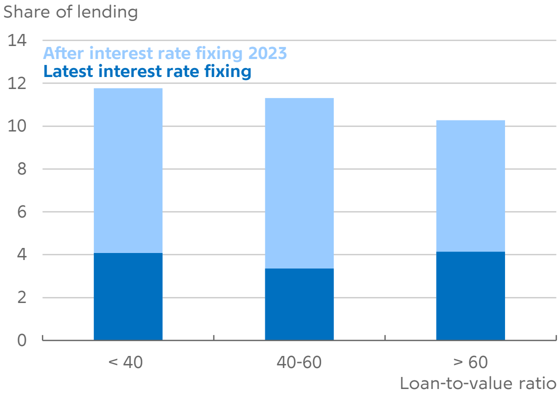
Low-income homeowners hit hardest by rising heating and interest costs

There is a substantial difference in how much heating costs and debt service will increase across income groups in the projection, see chart 11. Whether a household start having problems servicing their debt depends on a number of factors. In many countries, the regulation reflects that a debt service ratio above 40 per cent is considered to be very high.[13] Historically, households have spent just below 5 per cent of their disposable income on heating costs, which is why total heating and debt service costs relative to disposable income of more than 45 per cent may be considered high.[14]

The number of households with interest rate fixing in 2023 who gets heating costs and debt service to disposable income of more than 45 per cent will increase from approx. 9,000 to 24,000 as a result of the higher interest and heating costs. 15,000 households are in the lowest income quartile.

Households with both low income and limited liquid funds may find it particularly difficult to cover the increasing expenditures. The majority of homeowners in the lowest income quartile are over the age of 65 and typically have larger savings than younger homeowners. However, almost one in five in the lowest income quartile has available liquid funds of less than kr. 50,000 in the form of deposits including overdraft facilities.

Limited number of vulnerable homeowners are highly mortgaged Chart 12



Note: Share of loans with interest rate fixing in 2023 which will have high heating and debt service costs relative to disposable income ratios (more than 45 per cent) broken down by loan-to-value ratios.
Source: Danmarks Nationalbank, Statistics Denmark and own calculations.

Homeowners' response to rising costs could have a spillover effect on businesses

In addition to rising heating costs and interest payments, households are also affected by rising prices of other consumer goods. Wages have not risen at the same rate as prices, which erode the households' real income. The most affected households are likely to cut back significantly on heat consumption and other consumption in order to avoid defaulting on their debt. This is confirmed by the latest data, which show an approx. 20 per cent reduction in gas consumption in Denmark in August and September compared to the average of the last 6 years.[15]

13 See, for example, the European Systemic Risk Board, A Review of Macroprudential Policy in the EU in 2020, July 2021.

14 It is associated with great uncertainty to determine an average historical heat consumption, which i.a. depends on the home's heat source and energy efficiency, behaviour, energy prices and the temperature in the individual year. Based on the National Accounts statement of households' consumption of gas, liquid fuel and district heating etc. the average level since 1971 has been approx. 4 per cent of disposable household income excl. Electricity consumption for heating.

15 Calculated on the basis of monthly domestic consumption of natural gas from Eurostat (*link*).

Effect of higher interest rates and heating prices on households – how we proceeded

Box 2

The analysis is based on data from Danmarks Nationalbank's credit register and Statistics Denmark. The population is selected on the basis of data on loans from the credit register in the 2nd quarter of 2022, while the latest available data for personal income are based on the 2020 income year. The population consists of households with variable-rate housing loans for which the interest rate is due to be fixed in 2023. Households using only bank loans are not included. The population only includes households that own one home with a mortgage loan (holiday homes are excluded). Only households where the entire household is fully tax liable are included. Disposable income is calculated as the household's total personal income corrected for tax payments and interest deductions. Households' deposits are calculated for 2021 using account-specific data from the Danish tax authorities.

The effect of higher interest rates is estimated by increasing interest rates on mortgage loans for which the interest rate is due to be fixed in 2023 and on bank loans with variable interest rates. The calculations are based on an increase in interest rates on mortgage loans to 3 and 4 per cent for loans with interest rate fixing less or more than every two years, while the interest rate on mortgage loans with interest rate fixing every ten years is increased to 4.5 per cent. For bank loans, the existing interest rate is increased by 3 percentage points, which corresponds to the expected change in the ECB's interest rate[1]. Deferred amortisation, debt service type and, if applicable, interest rate ceiling are checked in the calculation of the debt service.

The effect of higher heating costs is estimated based on information in the Building and Housing Register (BBR), estimated heat consumption and the price development of heat sources[2]. Heat consumption is estimated based on the median of the calculated heat consumption (per square metre) from energy label reports for similar properties.[3] It is assumed that households' heat consumption remains unchanged. Households are expected to turn down the heating to some extent, which will result in an overestimate of the impact of higher heating prices. In addition, households will also be affected by higher prices of other consumer goods, including electricity. It is assumed that households service their debt and pay heating bills before paying for other goods and services, for which reason the effect of generally higher consumer prices is not reflected in the analysis.

1. See Danmarks Nationalbank, Tighter monetary policy has made financing more expensive, Danmarks Nationalbank Analysis (Monetary and financial trends), No. 10, September 2022 (*link*).
2. The price development is based on the latest available data for heating prices from the Danish Utility Regulator in combination with the development in the consumer price index from Statistics Denmark, where the most recent observations are from October 2022.
3. 'Similar properties' refers to properties that are of the same type (e.g. detached single-family houses), that have the same primary heat source and were built in the same period.

Limited number of vulnerable homeowners are highly mortgaged

Households with high heating and debt service costs relative to disposable income and a high loan-to-value ratio are particularly likely to cause losses for credit institutions. However, most households in the projection whose heating and debt service costs will account for more than 45 per cent of their disposable income generally have a relatively low loan-to-value ratio. It is thus 10 per cent of the households with a loan-to-value ratio above 60 that get high heating and debt service costs, corresponding to 15 kr. billion, see chart 12.

Economic circumstances may deteriorate further than assumed in the projection, e.g. in case of higher unemployment. Danmarks Nationalbank's stress test sheds light on credit losses in the event of a recession, as described further in the sections on capital and stress tests.

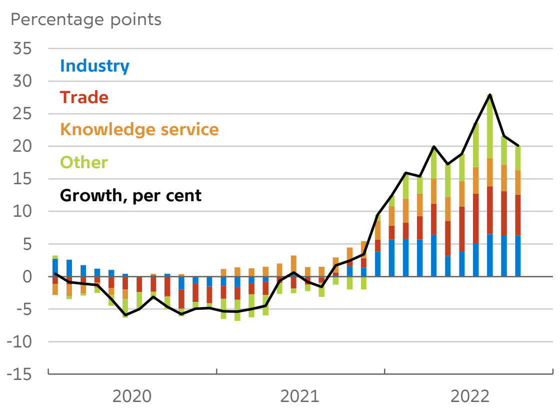
Especially medium-sized banks are expected to incur losses from vulnerable businesses

Supply problems and inflation have increased credit demand

Bank lending to the corporate sector has risen by 20 per cent over the last year, see chart 13. High lending growth may be a sign of accommodative credit standards and a build-up of risks. Several major banks have received a risk information from the Danish Financial Supervisory Authority for breaking the guideline in the Supervisory Diamond of an annual lending growth of 20 per cent.[16]

Growth is broadly distributed across industries and reflects, among other things, that corporate customers have needed additional financing on an ongoing basis due to challenges in supply chains and rising commodity and energy prices. Some of the financing has been spent on stockpiling. Currently, there are signs of high inventory levels in retail.[17] Slowing consumer demand increases the risk that some corporate customers will be left with excessive inventories.

High growth in bank lending Chart 13



Note: Lending to Danish non-financial undertakings and self-employed persons, year-on-year growth contribution. The most recent observations are from October 2022.
Source: Danmarks Nationalbank and own calculations.

16 Sew the Danish Financial Supervisory Authority for further information (*link*).

17 See Statistics Denmark, confidence indicators, valuation of inventories in the retail sector.

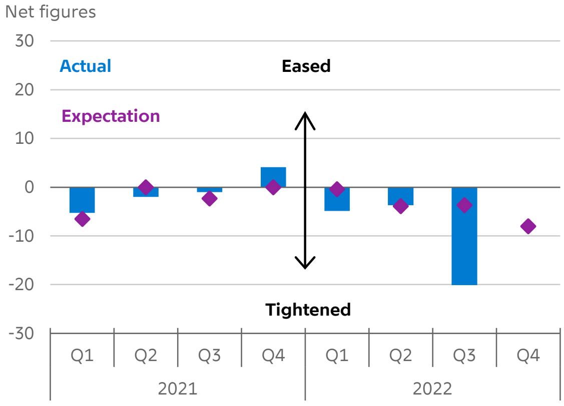
Credit institutions are tightening credit standards
In Danmarks Nationalbank's lending survey, the banks report tighter credit standards in the 3rd quarter of 2022 and expect continued tightening of credit standards in the 4th quarter, see chart 14. Banks estimate that the risk assessment of corporate customers, in particular, will lead to tighter credit standards. This should be seen in the light of an expectation of slower economic growth and an increase in corporate customers' costs due to high energy and commodity prices as well as higher interest rates.

Slowing consumer demand may result in greater losses on lending to corporate customers
Slowing consumer demand will further impair the debt service capacity of corporate customers.[18] This will put pressure on businesses that are already challenged by rising costs, and it may give rise to more defaults and higher loan losses.

Some weak businesses must be expected to default as a result of a general decline in economic activity. It is part of the natural business dynamics that non-viable companies close down and new one emerge. The banks' own credit quality data do not yet show clear signs that corporate customers are increasingly defaulting on their debt.

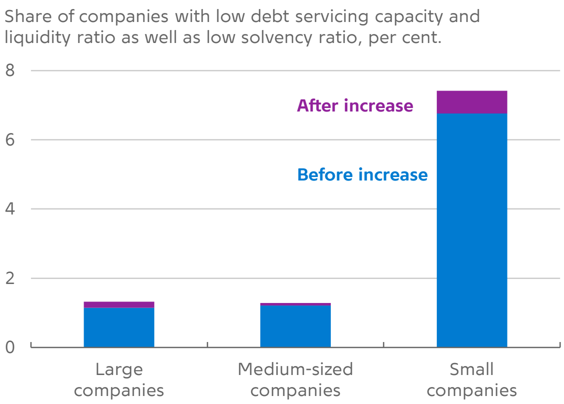
Small businesses less resilient and more exposed to rising prices and interest rates
Higher energy prices, combined with the current interest rate increases, are estimated to lead to an increased share of especially small businesses with low debt service capacity and low liquidity and solvency ratios, see chart 15.[19] However, the share only

Banks expect tighter credit standards Chart 14



Note: In Danmarks Nationalbank's lending survey, corporate customers cover 'Private non-financial corporations' and 'Sole proprietorships'. 'Expectation' is the banks' previously reported responses from the quarter before the present quarter. Net Chartes are the banks' responses weighted by their respective market shares. The most recent observations are from the 3rd quarter of 2022 for actual development and the 4th quarter of 2022 for expected development.
Source: Danmarks Nationalbank.

More small companies at risk as a result of rising energy and as well as interest rate hikes Chart 15



Note: Share of companies, excluding sole proprietorships, with low debt service capacity, liquidity ratio and solvency ratio before and after an increase in interest rates and energy prices broken down by company size according to the Danish Business Authority's accounting classes. The liquidity ratio is defined as low when the company's current assets cannot cover current liabilities (liquidity ratio below 100 per cent). Low solvency is defined as an equity-to-total-assets ratio below 30 per cent. See box 3 in Danmarks Nationalbank, Rising interest rates and prices may challenge banks' customers, *Danmarks Nationalbank Analysis (Financial Stability)*, No. 7, June 2022, for further information about the calculations.
Source: Danmarks Nationalbank, Bisnode, Statistics Denmark and own calculations.

18 The debt service capacity reflects the extent to which earnings before interest, taxes, depreciation and amortisation (EBITDA) are sufficient to cover their interest and principal payments. A debt service capacity below 100 per cent means that the business' EBITDA is lower than its expenses for interest and principal payments. In this analysis, debt service capacity is therefore defined as low if it is below 100 per cent.

19 The analysis is based on an interest rate increase of 3 percentage points compared to the interest rate level at the end of 2021 and a reduction in the businesses' EBITDA in the latest financial statements due to the increase in energy monthly domestic consumption of natural gas prices throughout 2022. Businesses are assumed to be able to pass on half of the cost increase from energy and commodities to customers via higher sales prices.

increases by less than 1 percentage point under the given assumptions.[20] Small businesses generally have lower liquidity and solvency ratios than the banks' other corporate customers and are thus generally less robust.

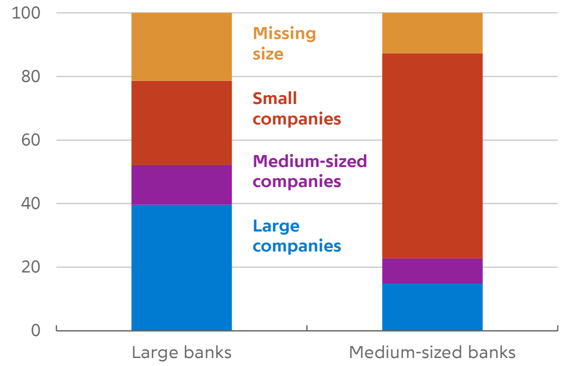
Lending to corporate customers with low debt service capacity and low solvency and liquidity ratios account for 2 per cent of banks' corporate lending. Banks are expected to be able to accommodate the potential loan losses due to the current increases in interest rates and prices. Losses are expected to affect medium-sized banks in particular, as lending to small businesses accounts for 65 per cent of their total corporate lending, see chart 16.

Exposures to letting companies have caused major losses in the past

With the prospect of weakened economic activity, cyclical businesses are particularly at risk. Historically, letting companies, whose main activity is the letting of properties for residential or commercial purposes, have been a cyclically sensitive industry. During the crisis in the 1990s and the financial crisis, the industry caused significant losses for Danish credit institutions and contributed to worsened downturns.[21]

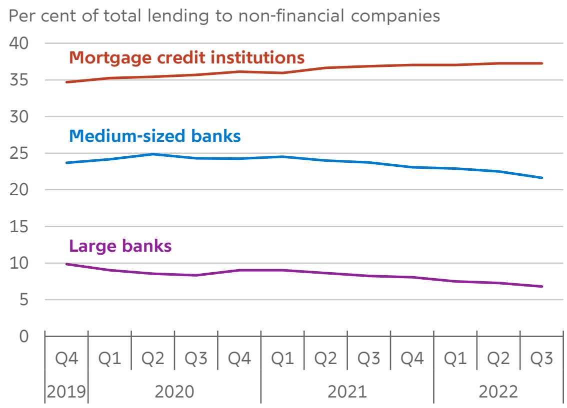
Credit institutions still have pronounced exposures to letting companies, see chart 17. Although letting companies are primarily mortgaged through mortgage credit institutions, the risk of credit loss is greatest for banks. This is because banks usually provide the financing which in the event of default ranks lowest in respect of the underlying collateral. Similar to the situation leading up to the financial crisis, medium-sized banks are more exposed to letting companies than large banks. Unlike then, banks have not experienced a similarly high growth in their lending to letting companies.

Small businesses account for a large share of lending by medium-sized banks — Chart 16



Note: Lending to Danish non-financial corporations by large and medium-sized banks in the 2nd quarter of 2022 broken down by company size according to the Danish Business Authority's accounting classes. For 21 per cent and 13 per cent of the lending by large and medium-sized banks, respectively, the financial statements do not disclose accounting class. Lending by large and medium-sized banks constitute 92 per cent of bank lending to Danish non-financial undertakings.
Source: Danmarks Nationalbank, Experian and own calculations.

Credit institutions have high exposure to letting companies — Chart 17



Note: Lending to letting companies as a proportion of total lending to non-financial undertakings and self-employed persons. Letting companies are defined as companies that are either part of the DB07 activities 682030 Other renting of real estate and 682040 Renting of non-residential buildings or that have loans secured by mortgages on properties classified as letting properties and where this debt constitutes at least half of the company's total debt to banks and mortgage credit institutions.
Source: Danmarks Nationalbank and own calculations.

20 Assessing the impact of price and interest rate shocks is subject to great uncertainty, and there may be business-specific conditions for which the analysis does not take into account. Among other things, account is not taken of whether businesses have hedged their market and interest rate risk via, for example, derivatives, while energy consumption is modelled at industry level.

21 See Ministry of Business and Growth, The financial crisis in Denmark. causes, consequences and lessons (Rangvid report), 2013 (*link*).

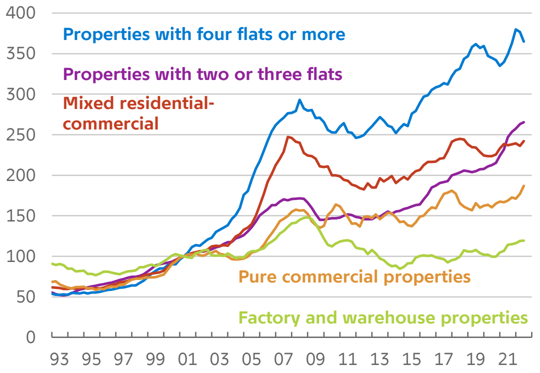
Price drops on letting properties can lead to credit losses in banks
Price developments for letting properties are generally cyclical, and in recent years, economic growth and low financing costs have contributed to significant price increases, see chart 18. Currently, market participants expect substantial price declines.[22]

Falling prices can be a challenge for banks, where a significant proportion of lending to letting companies has high loan-to-value ratios. Just over a quarter of lending in the 3rd quarter of 2022 had a loan-to-value ratio of more than 80 per cent.[23] Price falls may therefore mean that the collateral is not sufficient to cover the entire exposure in the event of default. The institutions may therefore risk realising losses.

Interest rate increase and income decline will reduce letting companies' debt service capacity
In terms of the degree of own financing, letting companies today appear to be more resilient to losses than in the run-up to the financial crisis. Thus, the median solvency ratio for the letting companies was 41 in 2006, while it was 47 in 2021, see chart 19. However, a considerable number of companies still have a low solvency ratio and/or debt service capacity. These companies may face difficulties.

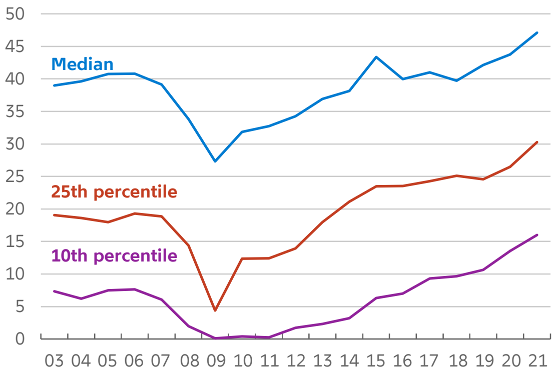
Danmarks Nationalbank has performed a sensitivity analysis of debt service capacity, in which letting companies' income is reduced by 10 per cent, and interest expenses are adjusted upwards to current interest rate levels. The analysis shows that the debt service capacity of some letting companies will be significantly reduced, see chart 20. However, these are mainly the ones that already have a high debt service capacity. Overall, the share of letting companies with a debt service capacity below 100 per cent increases from 24 to 43 per cent (weighted according to outstanding debt).

Prices of commercial real estate are cyclical and have risen considerably Chart 18



Note: Quarterly frequency. Four-quarter moving average. There are breaks in the series for properties with flats (two to three and four or more) in 2006 due to shifts in the categorisation. The new categorisation has been revised backwards in time by joint weighting of previously available series. The most recent observations are from the 2nd quarter of 2022.
Source: Statistics Denmark.

Letting companies have become more resilient Chart 19



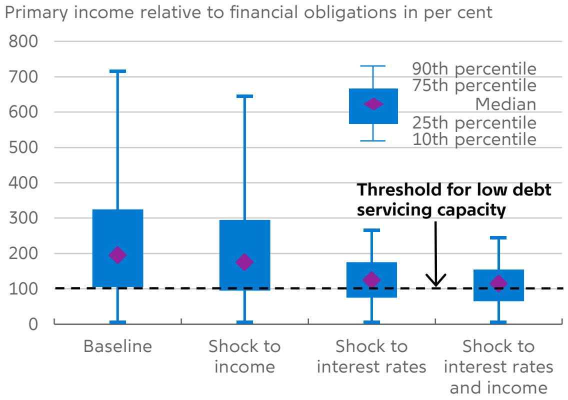
Note: Solvency ratios for letting companies, balance sheet-weighted. Solvency ratio has been calculated as equity to balance sheet total. The chart only comprises companies under the activity codes 682030 Other renting of real estate and 682040 Renting of non-residential buildings and includes approx. 22,000 companies in 2021, equal to approx. 60 per cent of the population of letting companies.
Source: Experian, Bisnode and own calculations.

22 See the Danish Property Federation's Market Statistics – Consensus Forecast, October 2022 (*link*) (in Danish).

23 Weighted according to outstanding debt, incl. mortgage lending. Other security may have been furnished for the loans in addition to the properties included in the calculation, and the loan-to-value ratios mentioned should therefore be regarded as upper limits.

Debt service capacity is significantly reduced in a scenario with higher interest rates and declining earnings

Chart 20



Note: Breakdown of the letting companies' debt service capacity in the event of a shock to income and interest expenses. See box 3 for further details. The companies have been weighted based on their share of the total outstanding debt.
Source: Danmarks Nationalbank, Bisnode and own calculations.

The sensitivity analysis does not take account of the use of interest rate derivatives. If letting companies use interest rate derivatives to hedge interest rate risk, the pass-through will be lower. See box 3 for further details on the underlying assumptions.

Sensitivity analysis of the debt service capacity of letting companies – how we proceeded

Box 3

The analysis assesses the robustness of letting companies' debt service capacity by shocking their debt service obligations and primary income. For debt service obligations, the same methodology and interest rates are used as described in box 2 of the household section. Only the interest rate level for variable-rate loans for which the interest rate is due to be fixed in 2023 or before is shocked. Primary income is shocked by reducing the letting companies' EBITDA (less value adjustments) by 10 per cent. In comparison, primary income for the real estate and letting industry decreased by 18 per cent from 2008 to 2009.

Information on primary income and value adjustments is deducted from the letting companies' financial statements. The most recent available financial statements are used, which for the most part are for 2021. Data on debt service obligations are linked to primary income data to cover the same financial period. Specifically, for each letting company, credit register data are used for the same quarter as the start date of the financial statements.

Debt service capacity is calculated here as the ratio of primary income less value adjustments, interest and principal payments. Thus, a debt service capacity of 100 per cent or more indicates that the letting company has sufficient primary income to cover its financial obligations in the short-term.

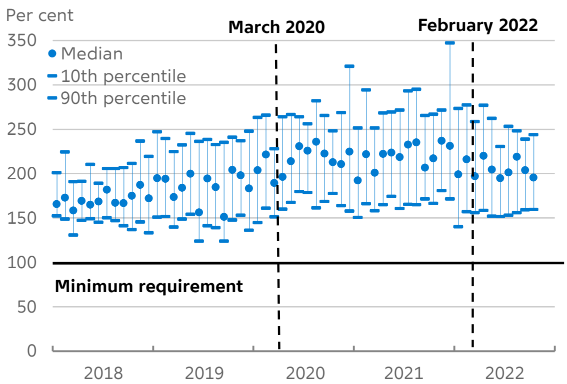
Accounting data on self-employed are not available, and these are thus not included in the analysis. A total of about 22,300 letting companies are included in the analysis. This corresponds to 62 per cent of letting companies and 82 per cent of total lending to letting companies.

Large fluctuations require more focus on liquidity management

Liquidity position remains robust
The systemic banks still have a sound liquidity position. All the systemic banks have a survival horizon with positive excess liquidity of at least five months in the most severe scenario in Danmarks Nationalbank's sensitivity analysis. This corresponds to the survival horizon in Danmarks Nationalbank's latest biannual analysis of financial stability. In the scenario, access to markets is assumed to be closed, while deposits fall significantly and loan facilities to customers increase.[24]

Both the systemic and the non-systemic banks meet the statutory requirement for liquidity (Liquidity Coverage Ratio (LCR)) and financing (Net Stable Funding Ratio (NSFR[25])) with a certain margin. Although still high, the banks' LCR has declined due to higher liquidity needs of customers and higher market volatility, see chart 21.

Systemic banks' LCR remains at a high level Chart 21



Note: The LCR is calculated as the bank's liquid assets divided by outgoing net cash flows over a 30-day stress period. The most recent observations are from end-October 2022.
Source: Danmarks Nationalbank.

24 For a method description of Danmarks Nationalbank's sensitivity analysis, see page 26 of Danmarks Nationalbank, Lower excess capital adequacy for the banks, *Danmarks Nationalbank Analysis*, No. 25, November 2019 (*link*).

25 See box 5 in Danmarks Nationalbank, Increased risks in credit institutions' housing lending, *Danmarks Nationalbank Analysis (Financial Stability)*, No. 28, December 2021 (*link*).

Raising liquidity has become more expensive
Banks currently have adequate liquidity buffers to handle market turmoil and meet an increasing demand for liquidity. However, raising liquidity has become more expensive. This comes after a long period of liquidity being readily available and with lower prices. This means, among other things, that banks are left to obtain financing in markets where both volatility and interest rates are noticeably higher than just 10 months ago, as explained in the section on the financial markets.

The changed market conditions for obtaining liquidity mean that banks need to be more prepared than in the past for increasing liquidity needs and loan demand from their customers. So far, although the risk of higher funding costs is present, banks have had access to liquidity via the markets. Ultimately, increased costs may translate into increased costs for customers.

Credit institutions cannot expect current market conditions to be temporary
It is important that the banks focus on the duration and maturity profile of their debt issuances so that they have adequate buffers to withstand periods with limited access to the markets.

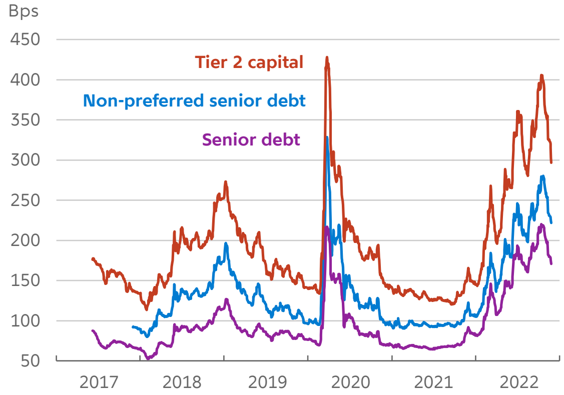
The price of banks' debt issuances is rising and subject to high volatility, see chart 22. This has affected the banks' behaviour in the markets, where the length of new issuances in 2022 has generally been shorter than in recent years. Banks are thus putting themselves in a more vulnerable position.

Increased liquidity needs for mortgage credit institutions in the event of a decrease in property prices
With the prospect of a continued fall in property prices, it is particularly important that mortgage credit institutions focus on maintaining a sufficient liquidity buffer to meet the supplementary collateral requirement.

All mortgage credit institutions are obliged to provide supplementary collateral for the issued bonds when property prices fall,[26] see chart 23. If this requirement

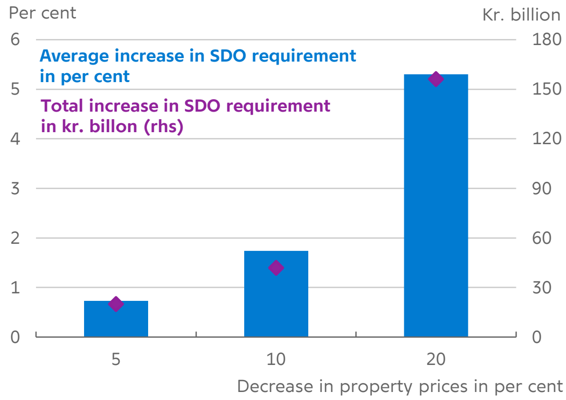
26 The value of the mortgage which the mortgage bond investors' have protection in, will be reduced when property prices decrease. Mortgage credit institutions must therefore provide supplementary collateral to maintain the mortgage value when loan-to-value is lower than 60 or 80 for corporate or household properties.

Increased prices of banks' debt issuances Chart 22



Note: Z-spread for iBoxx index for investment grade euro-denominated issuances for senior debt, non-preferred senior debt and supplementary capital (so-called Tier-2 capital). The most recent data are from 24 November 2022. This is based on euro issuances. A similar pattern is seen for issues in Danish kroner. According to the hierarchy of creditors in debt issuances, senior debt is ranked highest, while Tier-2 capital is ranked lowest.
Source: Refintiv Eikon.

The supplementary collateral requirement is increased when property prices fall Chart 23



Note: The chart shows how much the mortgage credit institutions' SDO requirement will increase on average as a percentage of their total balance sheet and the overall increase for mortgage credit institutions in kr. billion. Data are as of 31 December 2021.
Source: Danmarks Nationalbank, the mortgage credit institutions' ICAAP/ILAAP reports and own calculations.

is not met, the bonds will lose their status as covered bonds complying with Article 129 of CRR (SDOs).[27] It can have major negative consequences for the confidence in the Danish mortgage bonds system if one or more mortgage credit institutions lose their SDO status.

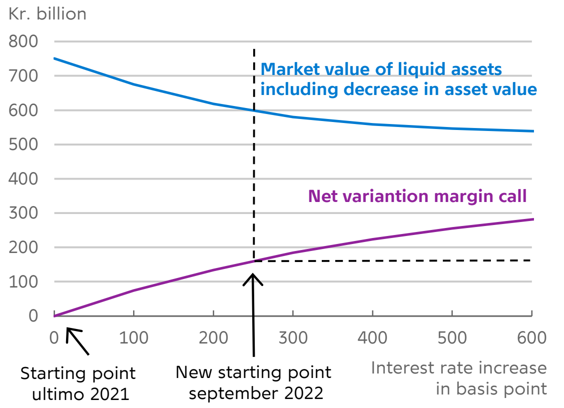
All mortgage credit institutions have liquidity and other assets to withstand a property price decrease of 20 per cent and at the same time meet all the other liquidity requirements.[28] However, in order to meet the increased supplementary collateral requirement (SDO requirement), it is necessary for mortgage credit institutions to also use other assets than LCR-defined liquid assets. The other assets consist of holdings of own covered bonds, guarantees and loans from group banks.

Liquidity needs of pension and life insurance companies influenced by volatile markets and higher interest rates

It is important that pension and life insurance companies focus on maintaining or expanding the number of repo counterparties, as this is where companies access liquidity for payments of variation margins from their derivatives contracts.

As the past year has shown, interest rates can rise sharply over a short period of time. As a result, pension and life insurance companies have had considerable increases in their liquidity needs in 2022. Companies may face a continued increase in liquidity needs if interest rates rise further, see chart 24. Danmarks Nationalbank has previously analysed the importance of pension and life insurance companies being able to handle the liquidity needs associated with variation margin calls from their derivative contracts.[29]

Continued robust liquidity coverage in the event of further interest rate increases Chart 24



Note: The pension and life insurance companies ' aggregate variation margin call (VM) based on Solvency II data. The blue line indicates the market value of the liquid assets held by the institutions, defined as Danish and German government bonds, Danish mortgage bonds and cash. From the end of 2021, interest rates have increased by around 250 basis points. Calculations are based on data from the end of 2021, but has been corrected based on a new starting point at the end of the third quarter of 2022.

Source: Danmarks Nationalbank, the Danish Financial Supervisory Authority, Refinitiv and own calculations.

Pension and life insurance companies need to focus on number of repo counterparties

To date, Pension and life insurance companies have been exempt from the requirement to provide cash for the variation margin calls as part of the implementation of the European Market Infrastructure Regulation (EMIR). This exemption expires in June 2023, after which all new interest rate swaps denominated in euro must be cleared centrally. After that

27 The covered bonds are instead classified as covered bonds complying with the Covered Bond Directive (ROs). ROs do not have the same status as they are subject to softer regulatory requirements and are therefore considered as less liquid.

28 The liquidity requirements of mortgage credit institutions are the OC requirement, the supplementary collateral requirement, the LCR and the Pillar II liquidity requirement. These requirements must be stacked, meaning that the same assets cannot be used to meet several of the requirements.

29 See Danmarks Nationalbank, Pension companies will have large liquidity needs if interest rates rise, *Danmarks Nationalbank Analysis*, No. 23, November 2019 (*link*).

date, it will only be allowed to provide variation margin calls in cash for new agreements, whereas bonds can still be used as collateral for existing agreements going forward. Over a period of years, the old agreements will gradually be replaced by new agreements, which will lead to an increased need for cash from June 2023, see chart 28.

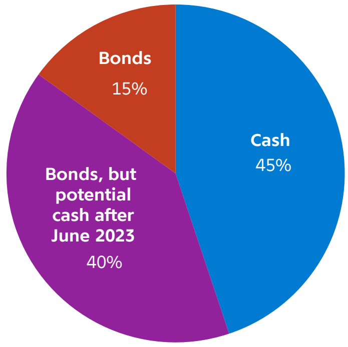
Companies have only limited cash holdings, for which reason it is essential that they secure access to liquidity via repo markets to meet variation margin calls. Despite the fact that it has been known for several years that the EMIR will be implemented, some companies still have only one or few repo counterparties as providers for access to liquidity.

Several banks are working to develop a setup that allows pension and life insurance companies to access centrally cleared repo transactions via the banks. In these cases, the companies will be indirect participants without the operational obligations arising from direct participation, such as tests of contingency plans and sharing of the risk of loss with third parties.

If it is not possible for pension and life insurance companies to obtain reasonable access to liquidity, it may be necessary to reduce their use of derivatives.

Liquidity needs will gradually increase from June 2023 as new interest swap agreements in Euros are purchased

Chart 25



Note: The distribution of assets used by pension and life insurance companies for clearing interest derivatives calculated end of 2022. From June 2023, 40 per cent of the companies' interest derivatives will gradually be cleared with cash rather than bonds. It will take about 5-15 years.
Source: Danmarks Nationalbank, the Danish Financial Supervisory Authority, Refinitiv and own calculations.

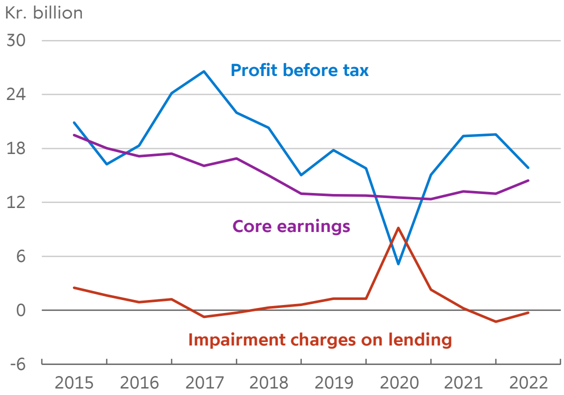
Higher impairment charges will reduce impact of rising net interest income

The profit before tax decreased for systemic credit institutions in the 1st half of 2022, see chart 26. The result for the first half of the year corresponds to an annual return on equity of 6.6 per cent. Negative value adjustments have contributed to the decline and should be seen in the light of large fluctuations in the financial markets and price declines.

On the other hand, the result is supported by early signs of increasing core earnings. The increase in core earnings reflects that the institutions are once again able to make more money from their core business. This has contributed to several institutions raising their earnings guidance for 2022 despite negative value adjustments.

Core earnings have benefitted from, among other things, increased net interest income. Several of the systemic credit institutions have raised deposit and lending rates in the wake of Danmarks Nationalbank's interest rate hikes in July, September and October. Following this, the deposit rate for a number of private and corporate customers is now no longer negative. However, deposit rates have generally risen less than money market interest rates, thereby increasing deposit margins.

Decline in credit institutions' profits in 1st half of 2022 Chart 26



Note: Half-yearly data for systemic credit institutions. Profit before tax has been adjusted for goodwill impairment charges. Core earnings are defined as net interest income, net fee income and income from administration margins less staff costs and administrative expenses as well as other operating expenses. The most recent observations are from the 1st half of 2022.
Source: Danmarks Nationalbank and own calculations.

Higher interest rates add to net interest income

The higher interest rates increase net interest income; however, not necessarily with a full pass-through to earnings, as higher interest rates and weaker economic growth can also lead to higher impairment charges.[30]

A simple projection of the net interest income of five systemic credit institutions[31] shows that annual net interest income may increase by kr. 16 and 17 billion, respectively, in 2023 and 2024 if the money market interest rate increases by 2.6 percentage points, see chart 27.[32] In the years leading up to the financial crisis, when money market interest rates rose by around 3 percentage points, net interest income increased by the same order of magnitude.

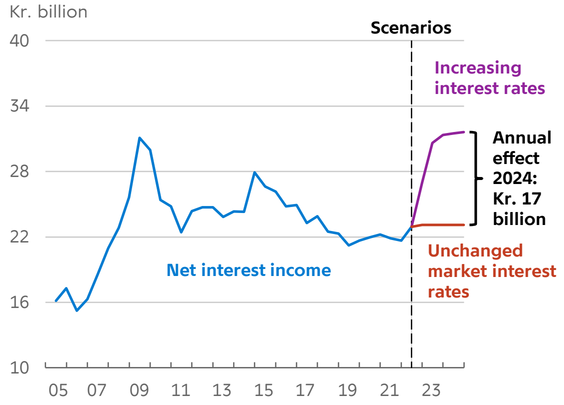
The increase in net interest income in 2023 and 2024 can mainly be attributed to the institutions having more interest-bearing assets than liabilities. See box 4 for a more detailed description of method and drivers.

Low impairment charges continue to support earnings

Since the end of 2020, the institutions' total impairment charges and provisions on loans and guarantees have remained largely unchanged, see chart 28. This covers, among other things, reversals of impairment charges for the coronavirus crisis on the one hand and new impairment charges for macro-economic and geopolitical risks on the other.

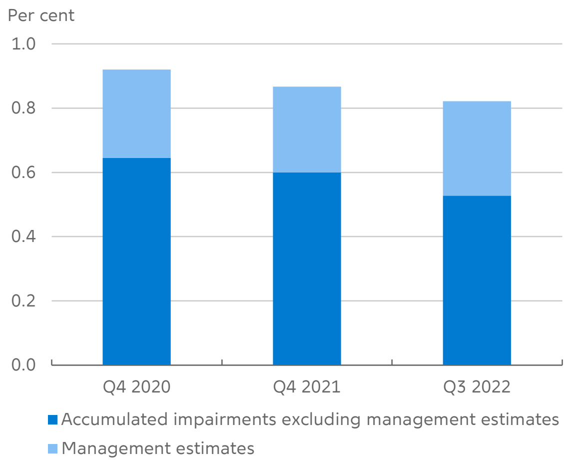
Institutions must take into account expectations for future developments when determining their impairment needs.[33] The institutions may apply

Higher interest rates expected to increase net interest income Chart 27



Note: Half-yearly data for Danske Bank, Nykredit Realkredit, Jyske Bank, Sydbank and Spar Nord. See box 4 for a more detailed description of the calculation method. The most recent observations are from the 1st half of 2022.
Source: Danmarks Nationalbank and own calculations.

Institutions' total impairment charges are roughly unchanged Chart 28



Note: Total impairment charges and provisions on loans and guarantees etc. as a percentage of loans and guarantees (gross) for the systemic credit institutions, excluding Nordea Kredit and Arbejdernes Landsbank. Management estimates include adjustments to impairment models.
Source: Banks' financial statements and own calculations.

30 The effect on banks' earnings of higher interest rates has previously been the focus of international studies. Borio et al. (2017) have, for example, found a positive correlation between higher interest rates and a steeper yield curve on the one hand and banks' profitability on the other. The effect is most pronounced in a situation with low interest rates and a flat yield curve. See Borio, C., Gambacorta, L., Hofmann, B., The influence of monetary policy on bank profitability, *International Finance*, 2017; 20: 48-63 (*link*). The ECB has also found that higher interest rates will have a positive impact on banks' net interest income over a period of several years. See ECB, Sensitivity Analysis of IRRBB – Stress test 2017 (*link*).

31 Danske Bank, Nykredit Realkredit, Jyske Bank, Sydbank and Spar Nord.

32 The short-term money market interest rate is expected to rise from around -0.4 per cent in the first half of 2022 to 2.2 per cent in 2024. The market rate in 2023 is based on the forward curve in Danmarks Nationalbank's latest projection from September 2022, after which the market rate will remain unchanged in 2024.

33 See Danmarks Nationalbank, Financial Stability 2nd half 2014, *Danmarks Nationalbank Analysis*, December 2014 (*link*), for a description of the accounting treatment of financial instruments, IFRS which came into force in 2018.

management estimates if expected credit losses are not captured by the impairment models, due to, for example, increased macroeconomic risks.

Despite impairment charges related to macroeconomic and geopolitical risks, the earnings of systemic credit institutions have overall been propped up by net reversals in the 1st half of 2022, see chart 26.

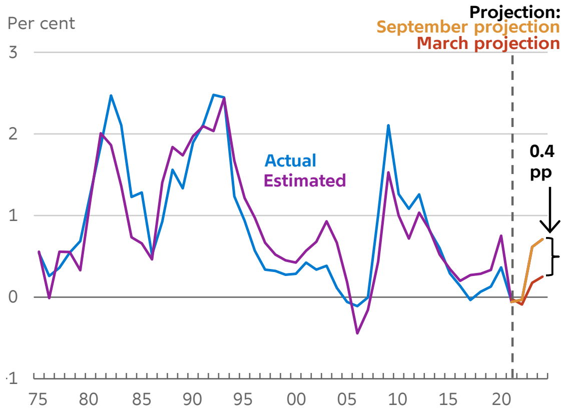
However, higher interest rates, high inflation and the prospect of an economic dampening are expected to reduce some customers' debt service capacity, as described in previous sections on credit to households and businesses. This entails a risk that the institutions will have to recognise further impairment charges. In Danmarks Nationalbank's lending survey, banks also indicated that they expect a certain increase in the share of impairment charges and losses on private and business lending in the 4th quarter of 2022.[34]

Deteriorating macroeconomic conditions may increase institutions' impairment charges

In Danmarks Nationalbank's latest projection, the growth estimate for the Danish economy was revised downwards compared to the projection from March 2022.[35] Based on a simple estimate, reduced economic growth of that magnitude is estimated in isolation to increase the annual impairment charge ratio on bank loans by just over 0.4 percentage points in both 2023 and 2024, see chart 29. For five systemic credit institutions,[36] this corresponds to an annual increase in impairment charges of almost kr. 7 billion in 2023 and 2024. A similar estimate for mortgage lending shows an annual increase in the five institutions' impairment charges of kr. 3 billion over the same period.[37]

Weakened outlook for Danish economy may increase impairment charges on bank lending

Chart 29



Note: Annual impairment charges on banks' loans as a percentage of loans and guarantees taken to income statement. The estimated relation for the impairment ratio includes GDP, unemployment rate and house prices as explanatory variables. The estimation period is 1975-2019. The deteriorated macroeconomic outlook is based on differences between Danmarks Nationalbank's September and March 2022 projections. The latest observation for the historical development is 2021.

Source: Danmarks Nationalbank and own calculations.

34 See Danmarks Nationalbank, Stricter requirements for private customers' economy, *Danmarks Nationalbank Lending Survey*, 3rd quarter 2022 (*link*), for further information on results regarding private customers.

35 See Danmarks Nationalbank, The pressure on the economy should be eased, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, No. 11, September 2022 (*link*), for a more detailed description of Danmarks Nationalbank's projection for the Danish economy.

36 Danske Bank, Nykredit Realkredit, Jyske Bank, Sydbank and Spar-Nord. Institution-specific conditions are not taken into account in the calculation of the impairment level.

37 Adjustments have been made for mortgage-like lending on the bank balance sheet. Bank lending includes loans to households, non-financial undertakings and the public sector.

However, the earnings impact may be smaller, as some of the impairment charges may already be included in management estimates or in the institutions' existing impairment scenarios.

Larger losses may dampen positive earnings effect from higher interest rates

A significant deterioration in the business cycle situation, combined with falling asset prices, will increase impairment charges and losses. In the long term, this may dampen the positive earnings effect from higher interest rates. The cyclical position may also affect other components of the institutions' earnings, such as net fee and commission income. Danmarks Nationalbank's stress test sheds light on how severe macroeconomic stress with higher interest rates affects banks' capitalisation.

Effect of higher interest rates on net interest income – how we proceeded

Box 4

In addition to the stress test model, Danmarks Nationalbank uses individual banking models for five systemic credit institutions, where the level of detail is greater than in the stress test. These models allow Danmarks Nationalbank to project the balance sheet and income statement. Based on this model framework, the effect of higher interest rates on institutions' net interest income is quantified. The scenario is based on an increasing money market interest rate, which is assumed to increase from around -0.4 per cent in the 1st half of 2022 to 2.2 per cent in 2024. The calculations are based on a static balance sheet and should not be confused with an actual projection.

The following is assumed about the pass-through from the money market interest rate to the other interest rates in the model:

- The deposit margin for households is increased to 1 percentage point in line with the increase in monetary policy interest rates. This corresponds to the average margin from 2003-2008, see chart A.
- The deposit margin for businesses is set to 0.5 percentage points, which was the level from 2003-2008, and which is not far from the current level, see chart A.
- The pass-through to lending rates is assumed to be 90 per cent and 78 per cent, respectively, for households and businesses.[1]
- Full pass-through to the other interest-bearing assets and liabilities, which includes a simplistic assumption that all the institutions' funding issuances have been swapped to a short-term interest rate.

The scenario is compared with an alternative scenario where the money market interest rate is maintained at the level from the 1st half of 2022. In chart B, the total effect of approx. kr. 17 billion is decomposed into the following three channels: The direct effect of the rising money market interest rate, which is primarily attributable to the fact that institutions have more interest-bearing assets than liabilities, the effect of a normalisation of the deposit margin and the effect of the lower lending margin.

Chart A
Banks' deposit margins are estimated to increase, while lending margins will fall slightly

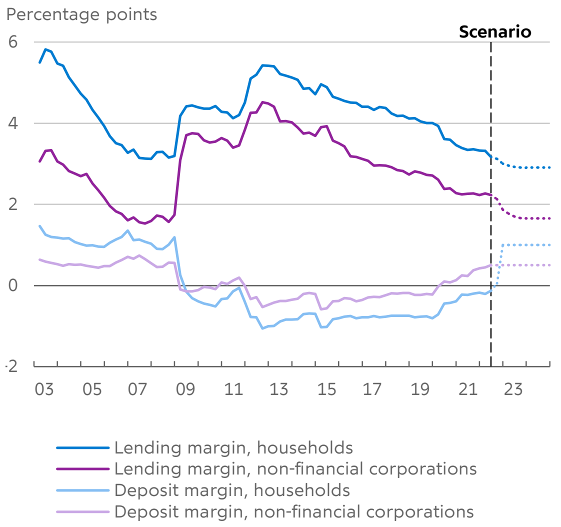
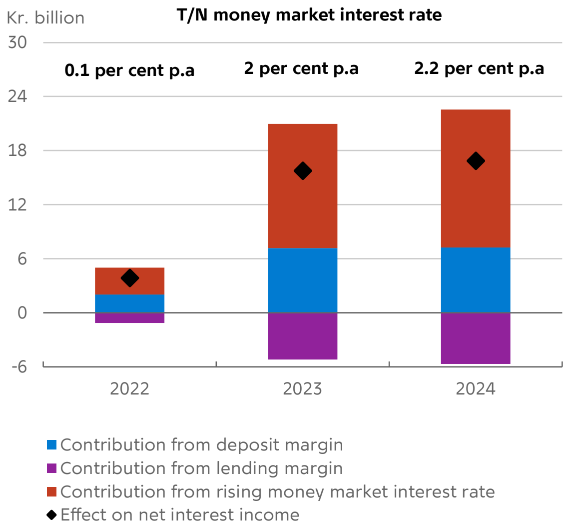


Chart B
Rising market interest rates contribute significantly to higher net interest income



Note: Chart A: Quarterly data for Danske Bank, Jyske Bank, Nykredit Bank, Sydbank and Spar Nord. The lending margin is defined as the difference between the average lending rate on loans denominated in Danish kroner to domestic households and non-financial corporations respectively and the T/N money market interest rate. Similarly, the deposit margin is calculated as the difference between the T/N money market interest rate and the deposit rates on deposits denominated in Danish kroner but with opposite sign. The most recent observations are from 1st half 2022. Chart B: Decomposition of change in net interest income for Danske Bank, Nykredit Realkredit, Jyske Bank, Sydbank and Spar Nord at consolidated level.
Source: Danmarks Nationalbank and own calculations.

1. See Danmarks Nationalbank, How does monetary policy work in Denmark?, *Danmarks Nationalbank Quarterly Review*, 2nd Quarter, Part 2, 2011 (*link*).

Some systemic institutions will be challenged by a severe recession

The capital position of credit institutions has generally been strengthened following adjustments of regulatory requirements since the financial crisis. Adjustments of both the quality and quantity of capital requirements have strengthened banks' ability to absorb losses, thereby contributing to the resilience of the banking system. However, the weaker economic outlook and high volatility in financial markets require banks to exercise caution in their capital planning in the period ahead.

Institutions have capital to build up countercyclical capital buffer
The countercyclical capital buffer is an important instrument to ensure sufficient resilience in the financial sector in the event of the materialization of risk and losses. The buffer differs from other capital requirements in that it varies in line with the development of cyclical systemic risks. The buffer aims to mitigate the negative impact on the real economy of stress in the financial system. This improves the ability of banks to maintain an adequate level of credit granting. However, to achieve this, the buffer must be built up before the systemic risks materialise.

The countercyclical capital buffer in Denmark will gradually be rebuilt to 2.5 per cent between now and March 2023.[38] The current excess capital of all systemic banks relative to the capital requirement is sufficient to meet the fully phased-in countercyclical capital buffer, see chart 30.

Important for institutions to ensure sufficient excess capital relative to risk-based MREL
In addition to the capital requirements, the institutions must meet an aggregate requirement for their eligible liabilities, the risk-based MREL.[39] The excess capital to the their risk-based MREL is generally lower than for their capital requirements, with an average excess capital of just over 4 per cent, see chart 31.

The maturity of senior debt over the coming quarters will further reduce banks' excess funds relative to the risk-based MREL. Some institutions are thus

38 See press release from the 36th meeting of the Systemic Risk Council (*link*) (in Danish).

39 The risk-based MREL covers the bank's MREL calculated on the basis of its solvency requirements and capital buffer requirements plus the mortgage credit institution's total capital requirements and debt buffer requirements.

dependent on debt issuances or significant accumulation of capital in order to accommodate the increase in the countercyclical capital buffer between now and March 2023.

It is particularly problematic if banks depend on market access within a short period of time to meet their risk-based MREL.[40] This should be avoided by building up sufficient excess capital relative to the requirement and ensuring a sufficiently long maturity profile on senior issuances.

Weakened macroeconomic outlook reflected in stress scenarios

To assess the robustness of the financial sector's capitalisation and ability to absorb losses, Danmarks Nationalbank conducts a stress test of the Danish banking sector every six months.[41] The stress test examines whether the institutions are sufficiently capitalised in different scenarios. This stress test contains three scenarios consisting of 1) a baseline scenario that follows Danmarks Nationalbank's latest projection[42], 2) a scenario with a larger economic downturn than in the baseline scenario and a significant interest rate increase from the first half of 2023 (recession), and 3) a scenario where the Danish economy is hit by a severe economic downturn and some interest rate increases in the second half of 2023 (severe recession), see chart 32.[43]

The choice of scenarios and the calibration of individual variables generally reflect the uncertainty surrounding the macroeconomic outlook. For example, the fall in house prices in the severe recession has been increased slightly compared to the June 2022 stress test to address the uncertainty surrounding the impact of higher interest rates on the housing market.

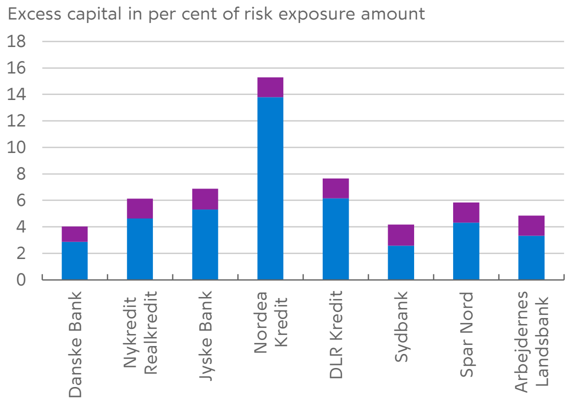
40 If an institution fails to meet the MREL, the Danish Financial Supervisory Authority will, as a general rule, require the institution to implement measures to ensure that the institution can again meet the MREL. For example, through the injection of new capital or selling off assets. In the worst-case scenario, control may be transferred to Finansiel Stabilitet for winding-up.

41 See Appendix 1 for an overview of the institutions that constitute the stress test population.

42 Danmarks Nationalbank, The pressure on the economy should be eased, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, No. 11, September 2022 (*link*).

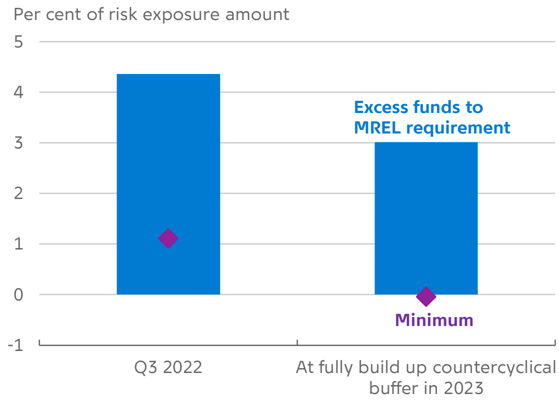
43 See Appendix 2 for a detailed description of the stress test scenarios.

Excess capital adequacy is sufficient to meet build-up of countercyclical buffer Chart 30



Note: The excess capital is calculated as the difference between CET1 capital and the CET1 capital requirement with a fully phased-in countercyclical buffer per 30 September 2022 and fully phased-in buffer rate respectively. The CET1 capital need is the CET1 capital requirement plus the part of the Additional Tier 1 capital and T2 supplementary capital requirements which are met by CET1 capital.
Source: Danmarks Nationalbank and own calculations.

A number of institutions have limited excess capital relative to the risk-based MREL following build-up of countercyclical buffer Chart 31



Note: The excess capital is calculated as the difference between the institutions' total MREL-funds as of 3rd quarter 2022 and their risk-based MREL based on the Danish Financial Supervisory Authority's MREL-decisions for 2022 plus the combined buffer requirement. The excess capital in case of a fully built-up countercyclical buffer therefore does not take into account any adjustments to the institution-specific MREL-requirements for 2023.
Source: Danmarks Nationalbank and own calculations.

Severe recession will challenge some systemic credit institutions

The stress test shows that all institutions are prepared for a recession with significant excess capital relative to the risk-based capital buffer requirements if the countercyclical capital buffer is released. A severe recession also leaves excess capital for systemic credit institutions, see chart 33. However, some of the institutions will be challenged and come close to the applicable capital buffer requirements.[44]

In the stress test scenarios, the capitalisation of individual banks is supported by the expected positive effect of higher interest rates. Their earnings will therefore be higher and provide a stronger defence against losses.

Stress test shows the importance of an effective countercyclical buffer

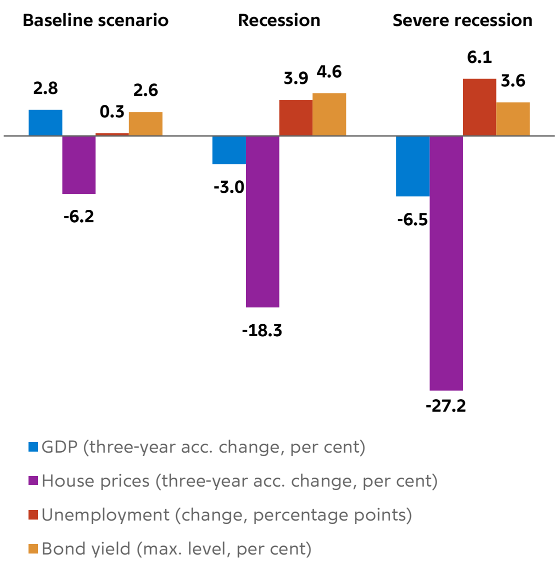
The effect of the countercyclical capital buffer being released is clearly seen in both recession scenarios, see chart 34. In the severe recession scenario, a release would ensure that no institution fails to meet their capital requirements. If the buffer is not released, the shortfall for the systemic credit institutions will be around kr. 10 billion.[45] Releasing the countercyclical capital buffer will therefore ensure that banks have more room to absorb losses and maintain an adequate excess capital relative to the capital requirements.

A key assumption in the stress test is that the release of the countercyclical capital buffer results in a corresponding decrease in the binding capital requirements of the individual institutions. In practice, the effect of releasing the countercyclical capital buffer in Denmark may be limited due to the interaction with other parallel requirements, such as the leverage ratio requirement.

44 Failure to meet capital buffer requirements is not in itself critical to the institution's survival going forward. If a bank's capital ratio falls below the buffer requirement, a number of restrictions will be imposed, e.g. in relation to dividend payments and interest payments on hybrid capital instruments. For further information on the consequences of a breach of capital requirements, see the memo from the Danish Financial Supervisory Authority on its expectations for capital plans and targets (*link*) (in Danish).

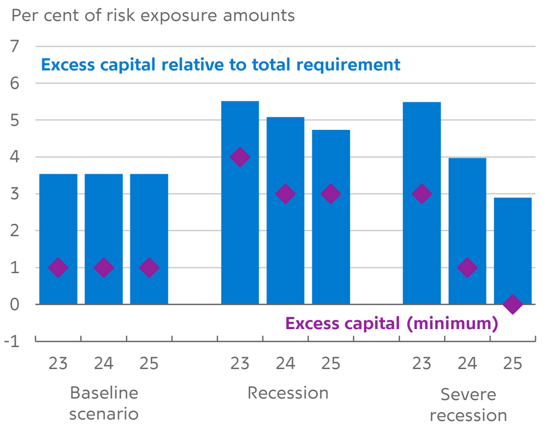
45 Releasing the countercyclical capital buffer requires a concrete overall assessment of the economic situation and the expected impact on the financial sector.

Macroeconomic scenarios in stress test — Chart 32



Note: The figures have been calculated based on annual averages. The bond yield indicates the average bond yield (per cent p.a.).
Source: MONA and own calculations.

Some systemic credit institutions come close to buffer requirements in severe recession scenario — Chart 33



Note: The chart shows the excess capital adequacy or capital shortfall of the systemic credit institutions that either have excess capital adequacy or a capital shortfall as a percentage of their total risk exposure amounts. The minimum value indicates the excess capital adequacy of the institution having the lowest one at the end of each year. Thus, these are not necessarily observations for the same institute. The excess capital adequacy in 2024 is higher in the recession scenarios than in the baseline scenario because the countercyclical capital buffer is presumed to have been released in both recession scenarios.
Source: Danmarks Nationalbank and own calculations.

The results of the stress test clearly show the importance of an effective countercyclical buffer which, when released, provides the intended capital relief. Capital buffers are an important tool for dealing with crises, and regulatory adjustments should aim at achieving more effective buffers in general.[46]

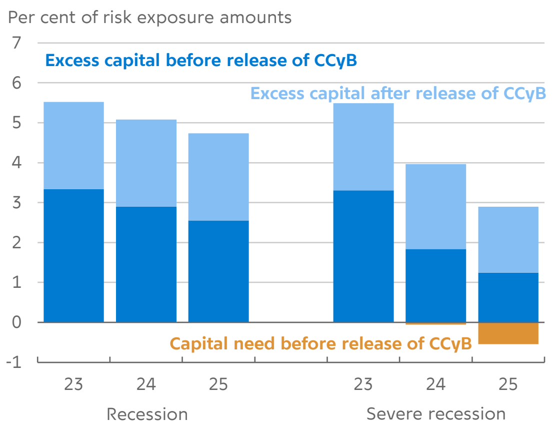
Banking package introduces additional capitalisation requirements in 2025
In addition to the capital effect of a severe recession scenario, individual institutions must also have sufficient capacity to meet future regulatory requirements. The European Commission's banking package is expected to enter into force on 1 January 2025 and will have an immediate capital impact with the introduction of new standard and internal methodologies for the individual risk types.

In particular, it appears that the revised market risk framework will increase Danish institutions' capital requirements in 2025. The total increase in the capital requirement in 2025 for systemic institutions is estimated at nearly kr. 6 billion.[47] For individual institutions, the effect of the banking package in combination with a severe recession will make it difficult for them to meet their combined buffer requirements – even if the countercyclical capital buffer is released, see chart 35. In addition, some of the other institutions will come close to their capital requirements.

The uncertainties surrounding the final effects of the package therefore underline the need for banks in general to exercise caution in their capital planning and for some institutions to increase their capital. Given the weaker economic outlook, institutions should be cautious when it comes to large dividend payments and share buy-backs. Intact buffers give individual institutions more flexibility to support credit granting through a recession.

Release of the countercyclical capital buffer (CCyB) increases excess capital adequacy relative to capital requirements and reduces capital needs in a severe recession

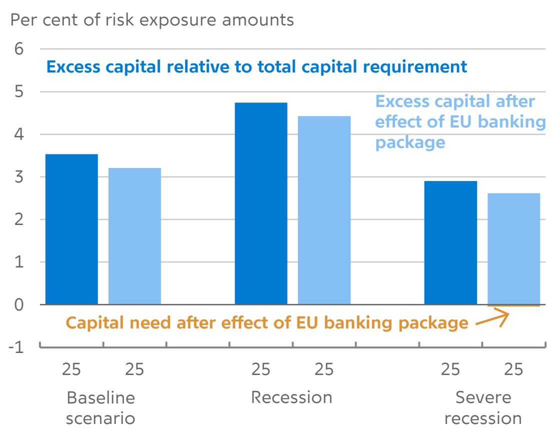
Chart 34



Note: The chart shows the excess capital adequacy or capital shortfall of the systemic credit institutions that either have excess capital adequacy or a capital shortfall as a percentage of their total risk exposure amounts. The stress test takes into account expectations for the build-up of the countercyclical capital buffer (CCyB).
Source: Danmarks Nationalbank and own calculations.

Impact of banking package in 2025 will lead to breach of capital requirements in severe recession

Chart 35



Note: The chart shows the excess capital or capital shortfall of systemic credit institutions in 2025, which includes, in addition to the capital effect of a severe recession scenario, the effects of the banking package. The countercyclical capital buffer is assumed to have been released in both recession scenarios.
Source: Danmarks Nationalbank and own calculations.

46 For a further discussion of this, see Danmarks Nationalbank, Regulatory adjustments are to contribute to more effective capital buffers, *Danmarks Nationalbank Analysis*, No. 9, August 2022 *(link)*.

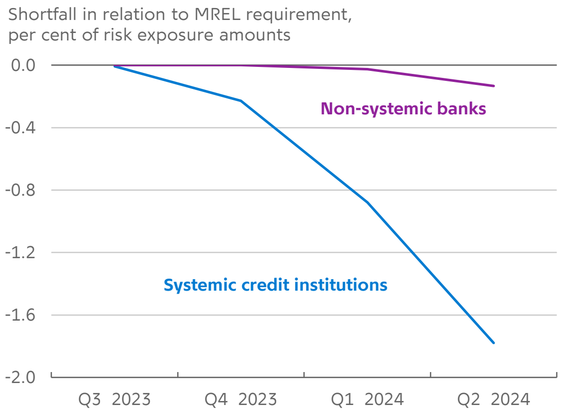
47 Assuming that the countercyclical capital buffer rate is 0 per cent.

Several institutions cannot meet total MREL during a period with stress and market turbulence

During periods with severe fluctuations in the financial markets where refinancing expired issuances may be difficult, the institutions must still be able to meet their total MREL.[48] The stress test shows that several systemic credit institutions and some of the non-systemic banks will not be able to meet their total MREL during a one-year period with stress and limited possibility of issuing new debt instruments, see chart 36.[49] However, this is only a breach of the buffer requirement in addition to the MREL.[50] In the severe recession scenario, the systemic credit institutions will have a shortfall in relation to the buffer requirement in addition to the MREL of approx. kr. 33 billion in the 2nd half of 2024.

Several systemic credit institutions challenged by MREL

Chart 36



Note: The shortfall in relation to the total MREL is defined as the amount by which the institutions (systemic and non-systemic) fall short of meeting the total MREL, divided by their total risk exposure amounts. The shortfall reflects both the maturity of existing issuances and capital loss due to stress.

Source: Danmarks Nationalbank and own calculations.

48 The total MREL covers the risk-based MREL as well as any adjustment required to meet the 8 per cent requirement for groups with mortgage credit institutions.

49 The institutions are not assumed to be able to issue new debt instruments in the period from the 2nd half of 2023 up to and including the 1st half of 2024.

50 If an institution only breaches the buffer requirement, the consequences will to a large extent be similar to the consequences of a breach of the buffer requirement in addition to the capital requirement.

Financial institutions need to address climate-related risks

Climate change and the consequences of the green transition have the potential to influence financial stability. It is important for the individual financial institution to manage the climate-related risks that are significant to their business. Therefore, they need to develop capacity to identify and analyse possible risks and their potential consequences. Many financial institutions are in the process of identifying which climate-related risks are relevant to them, but there is still a lot to be done in terms of managing these risks.

Climate-related risks must be managed as part of the ongoing risk management procedures

Managing significant risks of loss is part of the ongoing risk management in banks. This could, for example, take the form of well-known measures such as limiting the exposure to a risk and increasing provisions for losses or including the risk in the calculations forming the basis of risk weights to increase capital adequacy. Climate-related financial risks need to be addressed in line with other risks.

As such, climate-related risks are not new. Financial institutions have previously suffered losses as a result of natural disasters and have for example felt the consequences of rapidly rising energy prices earlier this year. But climate change differs from conventional risks in that the scale and frequency of climate-related events are expected to grow to unprecedented levels. As a result, management of climate-related risks cannot be based on previous experience and data alone. For the same reason, investors' uncertainty about future developments may lead to sudden changes in expectations and price corrections in the financial markets.

In 2020, Danmarks Nationalbank assessed that banks were well-prepared for transition risks in the short and medium term, and the ECB has subsequently described how the green transition as a whole poses a limited risk for banks in the euro area.[51] The ECB also assesses that the long-term financial risks from climate change are substantially greater than the risks stemming from the green transition.

51 See Danmarks Nationalbank, A gradual green transition supports financial stability, *Danmarks Nationalbank Analysis*, November 2020 (*link*) and ECB/ESRB Project Team on climate risk monitoring, Climate-related risk and financial stability, 2021 (*link*).

Danmarks Nationalbank has initiated work to identify the climate-related financial risks that are deemed to potentially be significant for the financial system in Denmark. Box 6 shows the climate-related financial risks that are currently identified to be the most important risks. The overview is based on an assessment of the likelihood of:

- A climate-related event happening.
- The event can imply challenges for parts of the economy.
- These challenges can have significant financial implications.

All three probabilities must be greater than zero for there to be a risk to the financial sector.

Some businesses may be affected by higher costs of greenhouse gas emissions

As a result of the green transition, the cost of greenhouse gas emissions is expected to rise significantly. Thus, emission-intensive businesses will have to change their behaviour and employ new technologies in the future. For those that fail to adjust their production processes, rising costs may put pressure on their profitability. The value of physical assets in emission-intensive production could also decline significantly – also reffered to as stranded assets. This will be the case if the transition means that these assets cannot be used profitably or resold for other purposes.

Credit institutions lend to businesses in the emission-intensive industries, such as maritime transport, aviation, agriculture and horticulture, concrete and bricks, electricity supply and land transport. Some institutions also help fund oil and gas extraction activities.

In addition, rising emission costs may cause price of financial assets to drop

Institutional investors such as pension and insurance companies as well as investment funds have invested in financial assets issued, among other things, in the above-mentioned emission-intensive industries, especially abroad. The price of financial assets may

Five significant climate-related risks for the Danish financial sector

Box 5

Risk	Description	Type of climate risk	Type of financial risk	Timeframe
Higher cost of emissions	Declining corporate earnings due to higher greenhouse gas emission costs	Transition	Credit risks	Short
Price decline on financial assets	Declining corporate earnings due to higher costs of emissions and climate change and green abroad	Transition	Market risks	Short
Global climate change and transition	Corporate losses due to disruptions in international value chains caused by climate change and green transition abroad	Climate change/ transition	Credit risks	Long/ short
Vulnerability towards multiple interacting risks	For example, declining earnings in agriculture due to the materialisation of climate risks, such as drought, extreme rain, higher costs of emissions and more volatile energy prices	Climate change/ transition	Credit risks	Medium
Energy requirements for buildings	Decrease in the value of real estate due to stricter energy source and efficiency requirements in buildings	Transition	Credit risks	Medium

Note: Risks are listed in non-priority order.

fall as a result of declining corporate earnings. The mere expectation that it may not be possible in future to use the capital stock profitably could cause the value of the relevant financial assets to plummet.

Consequences of global climate change may have an impact on the financial sector in Denmark
Denmark is a small open economy with large international capital movements. The dependence of the Danish economy on conditions abroad increases vulnerability towards climate-related risks in other countries. For example, insurance and pension companies' investments abroad accounted for 54 per cent of their total portfolio at the end of June 2022. The value of these assets is sensitive to climate change and the green transition in the respective countries.

In addition, Danish companies can, via global value chains, be affected by climate-related events, which for example may affect a foreign subcontractor or a buyer of Danish-produced intermediate products. Many Danish businesses take part in the international trade in goods and services, and financial institutions are exposed to them (e.g. by way of loans, credits, equities, corporate bonds). In addition, there may be risks associated with a green transition that is not coordinated internationally. If Denmark implements climate policy before and/or to a greater extent than our trading partners, this could worsen the conditions for Danish companies.

Materialisation of multiple simultaneous climate-related risks can impact agriculture
Several physical climate events and/or events associated with the transition may occur at the same time. Agriculture is particularly exposed to simultaneous risks. For example, periods of extensive drought can reduce harvest yields. At the same time, agriculture is relatively energy- and emission intensive and is thus vulnerable to increasing costs via these channels. This summer have shown how drought can also contribute to increasing electricity prices. In addition, this industry can be affected by a possible taxation of greenhouse gas emissions and other climate measures. Agriculture is already highly indebted, and some credit institutions have a significant credit risk as a result of their lending to this industry.[52]

Energy-efficient buildings targets will require major energy renovation efforts
Energy consumption associated with the use of buildings represents a significant share of total greenhouse gas emissions. Against this background, the EU has a goal of keeping the building stock close to energy-neutral and fossil-free by 2050.[53] Reducing emissions from buildings can be achieved, among other things, by tightening the regulations for new construction and encouraging massive energy renovations of the existing building stock. At the same time, green and efficient energy sources could be installed.

Real estate constitutes the security behind the majority of credit institutions' lending. Investments in energy renovations are usually profitable in the long term, but require access to financing and a sufficient debt servicing capacity. If the energy renovations are not carried out, the mortgage values behind some loans can decrease and thereby increase the risk of loss if the borrower cannot repay the loan. For more information about possible consequences for credit institutions, see box 6.

52 See, for example, Danmarks Nationalbank's latest assessment of the financial situation for agriculture in Danmarks Nationalbank, Low interest rates and ample lending capacity put pressure on loan standards, *Danmarks Nationalbank Analysis*, November 2018 *(link)*.

53 See more about the EU's climate targets for the building stock and proposed amendments to the EPBD (*link*).

EU energy efficiency proposals could reduce the mortgage value behind some housing loans

Box 6

The European Commission has proposed new energy improvements to the least energy-efficient part of the building stock.[1] The proposal means that the energy labels of these buildings must have improved by one class on the label scale by 2030 and by another class by 2033. The proposal is being negotiated currently with the European Parliament and the Council of Ministers. Only after a final adoption, the political negotiations in Denmark about the implementation can start. If the EU Commission's proposal is adopted, the credit institutes should, in their risk assessment, take into account, that the mortgage value behind some mortgage loans may drop as a result. This may, for example, be the case if the energy label cannot be increased by carrying out profitable energy renovations, or if the home owner is not considered to have access to the necessary financing.

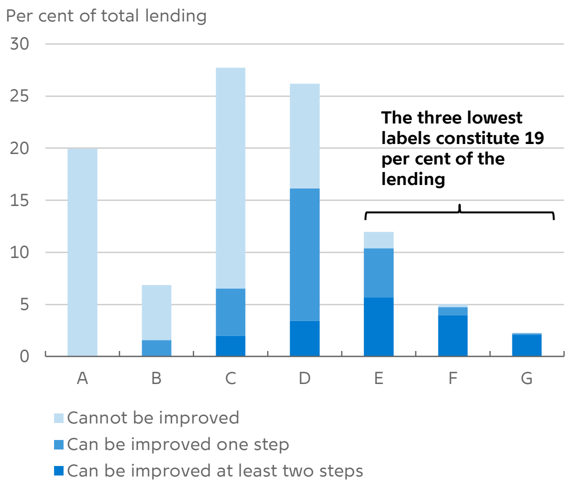
Based on the energy reports for homes, Danmarks Nationalbank estimates that the homeowners behind approx. 79 per cent of the lending in the three lowest energy classes, E-G, can improve their energy label by at least one class through profitable renovations, see chart to the right. About 61 per cent of homeowners can improve their energy label by two classes.

A study of sales of single-family homes in the 2014-2020 period shows that pricing in the housing market has often not taken into account the energy efficiency of a house.[2] Most energy renovations have thus increased the sales price by less than the renovation cost. This is particularly so in certain rural areas, e.g. on Lolland, Falster and in parts of southern and western Jutland, where the price per square metre is significantly lower. At the same time, relatively many single-family houses in these areas have a low energy rating and therefore a significant potential for energy renovations that can lower ongoing costs.

Homeowners' focus on energy consumption in the home is expected to increase as a result of rising energy prices. Against this background, energy renovations can also become a more integrated part of pricing in the housing market in future. Energy reports are based on current energy prices at the time when each report was prepared, which is why most have been prepared on the assumption of energy prices being significantly lower than today. If energy prices remain high, even more homeowners will have a financial incentive to energy-renovate. This can support those households that are significantly impacted by rising heating bills, see the section on households.

The analysis is based on microdata comprising all valid energy reports from sparenergi.dk, as well as all housing loans from Danmarks Nationalbank's credit register. The complete dataset contains information on 348,985 single-family homes. According to the Danish Energy Agency, at the last count, there were a total of 406,180 valid energy reports, whereas there are a total of 1,177,486 single-family houses in Denmark in 2022. There is no information available on the energy efficiency of the approximately 65 per cent of single-family houses that do not have valid energy reports.

The majority of the most energy-inefficient homes have potential for profitable energy savings



Anm.: Lending secured by mortgages on detached single-family houses with valid energy labels broken down by current energy label, equal to 35 per cent of lending. The categories show how many steps a home can advance on the energy label scale through profitable renovations, according to the energy report. A profitable renovation is when the homeowner's total savings over the life cycle of the installation equal or exceed the cost of the renovation. Energy label data were collected in 2021, and data on lending are as at the end of the 2nd quarter of 2022.

Kilde: Spareenergi.dk, Danmarks Nationalbank and own calculations.

1. See proposal for a Directive of the European Parliament and of the Council on the energy performance of buildings, Celex no. 52021PC0802 (*link*). It is currently being negotiated how the energy label scale may be revised, and how large a part of the housing stock must improve the energy class. Hence, great uncertainty remains about the extent to which the proposal may end up affecting Danish home owners.
2. See Danmarks Nationalbank, Energy renovations of houses will pay for themselves by the heating bill – not by the sales price, *Danmarks Nationalbank Economic Memo*, No. 10, September 2022 (*link*) and Danmarks Nationalbank, Opportunities and risks in the residential sector during a green transition: House prices, energy renovations and rising energy prices, *Danmarks Nationalbank Working Paper*, No. 190, September 2022 (*link*).

Appendix 1
Analysis data

The analysis applies the term 'credit institutions' when referring to the activities of both banks and mortgage credit institutions. The term 'bank' refers specifically to entities carrying out banking activities. These institutions are listed in table 1.

The analysis of Danish credit institutions' earnings, liquidity and own funds as well as the stress test comprise the eight systemic credit institutions designated by the Danish Financial Supervisory Authority in 2021. In June 2021, Arbejdernes Landsbank was designated as a systemic credit institution by the Danish Financial Supervisory Authority after it had acquired a majority shareholding in Vestjysk Bank. Vestjysk Bank is therefore included under Arbejdernes Landsbank in the analysis. The analysis and stress test also include the non-systemic banks. This group consists of the institutions in group 2 defined by the Danish Financial Supervisory Authority for 2021, with the exception of Saxo Bank and Arbejdernes Landsbank (incl. Vestjysk Bank). Saxo Bank has been omitted due to the bank's business model. Arbejdernes Landsbank has been omitted due to its designation as systemically important. The grouping applies retrospectively.

In the analysis and assessment of lending activity, focus is on the grouping of large and medium-sized banks in Danmarks Nationalbank's lending survey. Large banks are the Danish Financial Supervisory Authority's group 1 plus Nordea Danmark, while medium-sized banks are the Danish Financial Supervisory Authority's group 2 plus Handelsbanken and Santander Consumer Bank.

Institutions in the analysis by total assets as at 30 June 2022, kr. million Table 1

Systemic credit institutions	Amount
Danske Bank (incl. Danica)	4,073,992
Nykredit Realkredit	1,588,434
Jyske Bank	667,143
Nordea Kredit	444,410
DLR Kredit	179,807
Sydbank	169,080

Continues ...

Institutions in the analysis by total assets as of 30 June 2022, kr. million
... continued

Systemic credit institutions	Amount
Spar Nord	118,845
Arbejdernes Landsbank	106,087
Total systemic credit institutions	7,347,798
Systemic banks	
Danske Bank	2,524,000
Jyske Bank	357,075
Nykredit Bank	220,331
Sydbank	171,046
Spar Nord	118,936
Arbejdernes Landsbank	106,087
Total systemic banks	3,497,475
Non-systemic banks	
Ringkjøbing Landbobank	65,226
Sparekassen Danmark	57,218
Sparekassen Kronjylland	38,329
Lån & Spar Bank	29,372
Sparekassen Sjælland-Fyn A/S	28,442
Middelfart Sparekasse	17,566
Total non-systemic banks	236,152
Mortgage credit institutions	
Nykredit Realkredit	1,493,525
Realkredit Danmark	793,533
Nordea Kredit	444,410
Jyske Realkredit	341,825
DLR Kredit	179,807
Total mortgage credit institutions	3,253,100

Note: The balance sheet total for the systemic credit institutions is stated at group level. The credit institutions have thus been stated inclusive of assets in their subsidiaries in the form of, for example, mortgage credit institutions. The balance sheet total for systemic banks, non-systemic banks and mortgage credit institutions is stated at institution level. Exceptionally, Arbejdernes Landsbank has been included at group level to reflect the consolidation with Vestjysk Bank. The assets in the financial statements of the mortgage credit institution Nykredit Realkredit also reflect the Nykredit Group's funding of the subsidiary Totalkredit.
Source: Danmarks Nationalbank.

Appendix 2
Stress test scenarios

The stress test is based on three scenarios for the macroeconomic development in Denmark over the 2023-2025 period. The three scenarios consist of a baseline scenario that follows Danmarks Nationalbank's latest projection[54], as well as two recession scenarios, where the downturn in one starts at the beginning of 2023 (recession) and in the other six months later (severe recession).[55]

Recession reflects a situation where it will require further interest rate hikes from central banks to bring inflation under control. Interest rates abroad and in Denmark continue to rise in 2023, and are thus 2 percentage points higher over the entire yield curve compared to the baseline scenario. This coincides with the Danish and international economy being impacted by declining confidence among businesses and consumers. Both factors put a damper on economic growth and reduce Danish export market growth, whereby GDP and house prices fall and unemployment rises. The accumulated GDP growth is reduced to -3.0 per cent over a three-year period compared with 2.8 per cent in the baseline scenario. In addition, house prices fall by over 18 per cent over three years.

In the severe recession scenario, a global crisis hits the world economy in the 2nd half of 2023, and the Danish economy experiences a severe downturn. This is combined with an interest rate increase of 1 percentage point over the entire yield curve relative to the baseline scenario. The severe downturn and the dampening effect of the interest rate increase on growth in both Denmark and abroad reduce Danish exports. GDP drops by 6.5 per cent over a three-year period, while the unemployment rate increases by 6.1 percentage points from 2023 to 2025. Finally, house prices fall by over 27 per cent over three years.

Danmarks Nationalbank's method for preparing the severe recession scenario is based on the previous macroeconomic development. For example, this means that there stress is more pronounced after a period with marked growth in the economy. The method focuses on the development in GDP, unemployment and house prices. For each of these variables, a systematic approach is applied to determine benchmarks for their rate of increase (unemployment) or decrease (GDP growth and house prices) over the timeframe covered by the scenarios.[56]

The benchmarks for the three variables are calculated independently of each other. It is possible that the actual development in the key variables deviates slightly from the benchmarks, as the relation of the variables is determined by Danmarks Nationalbank's economic model, MONA. In the scenarios, the variables therefore cannot follow just any development, but must evolve consistently with their interrelationship in MONA.

In this stress test, the GDP benchmark is above the level of the benchmark in the stress test conducted in the spring.[57] This is because the starting point has improved since the last stress test, as there was positive growth in the 1st half of 2022. In the severe recession scenario, the development in GDP and unemployment largely follows the benchmarks. The fall in house prices in the severe recession scenario has been increased relative to the latest stress test to reflect uncertainty about house price developments.[58] Therefore, the fall in house prices deviates from the benchmark in this scenario.

54 Danmarks Nationalbank, The pressure on the economy should be eased, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, No. 11, September 2022 (*link*).

55 See table 2 for selected key chartes for the three scenarios.

56 The scenarios are developed in cooperation with the Danish Financial Supervisory Authority. The approach used to generate the scenarios is described in detail in Danmarks Nationalbank, The largest banks satisfy capital requirements in stress test, *Danmarks Nationalbank Analysis (Stress Test)*, No. 21, November 2018) (*link*).

57 The impact of the coronavirus pandemic on GDP in the 2nd quarter of 2020 has been taken into account in the calculation of the GDP benchmark.

58 See page 34 of Danmarks Nationalbank, The pressure on the economy should be eased, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, No. 11, September 2022 (*link*).

Selected key figures in Danmarks Nationalbank's stress test scenarios

Table 2

	Baseline scenario	Recession	Severe recession
2023			
GDP, per cent year-on-year	-0.1	-1.7	-0.7
Private consumption, per cent year-on-year	0.4	-1.2	-0.2
Export market growth, per cent year-on-year	2.5	-1.3	0.7
House prices, per cent year-on-year	-5.6	-10.7	-8.8
Gross unemployment, per cent of labour force	2.7	3.2	2.9
Average bond yield, per cent p.a.	2.4	3.9	2.6
2024			
GDP, per cent year-on-year	1.2	-2.8	-5.1
Private consumption, per cent year-on-year	1.1	-4.2	-5.4
Export market growth, per cent year-on-year	2.9	-4.0	-10.0
House prices, per cent year-on-year	-1.8	-9.1	-19.7
Gross unemployment, per cent of labour force	3.0	5.7	5.7
Average bond yield, per cent p.a.	2.4	4.4	3.4
2025			
GDP, per cent year-on-year	1.7	1.5	-0.7
Private consumption, per cent year-on-year	1.7	0.2	-2.3
Export market growth, per cent year-on-year	2.6	1.5	-3.6
House prices, per cent year-on-year	1.2	0.5	-0.7
Gross unemployment, per cent of labour force	3.0	7.1	9.0
Average bond yield, per cent p.a.	2.6	4.6	3.6
Cumulative change			
GDP, three-year cumulative change per cent	2.8	-3.0	-6.5
House prices, three-year cumulative change per cent	-6.2	-18.3	-27.2

Note: Annual averages. House prices are cash prices of single-family houses. The baseline scenario follows Danmarks Nationalbank's projection up to 2024, while the development in 2025 is a technical projection. It should be noted that rounding may mean that the stated accumulated growth does not necessarily correspond to the cumulative growth that can be calculated based on the chartes in the table.

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