ANALYSIS

DANMARKS NATIONALBANK

24 MARCH 2022 — NO. 4

MONETARY AND FINANCIAL TRENDS – MARCH 2022

Rising inflation and Russian invasion have increased volatility

Decline in equity prices and large interest rate movements

Higher inflation has sparked expectations of tighter monetary policy, prompting higher Danish government bond yields, among other things. Moreover, Russia's invasion of Ukraine has led to increased uncertainty about future interest rates as well as falling equity prices.

Danish krone not significantly affected by geopolitical turmoil

Around year end a big drop in short euro interest rates increased krone demand, implying interventions in the FX market of kr. 47 billion by Danmarks Nationalbank. Subsequently, the krone has weakened moderately and has not been significantly affected by the geopolitical turmoil.

Tighter financing conditions in 2022 from a low level

Rising mortgage rates, falling equity prices and increased risk premia have contributed to tighter financing conditions in 2022. However, real interest rates remain low in a historical perspective, as higher inflation expectations have partly offset some of the increase in market rates.

CONTENTS

2 DANMARKS NATIONALBANK ANALYSES MONETARY AND FINANCIAL TRENDS

3 GLOBAL FINANCIAL MARKET DEVELOPMENT

11 THE DANISH MONEY- AND FOREIGN EXCHANGE MARKET

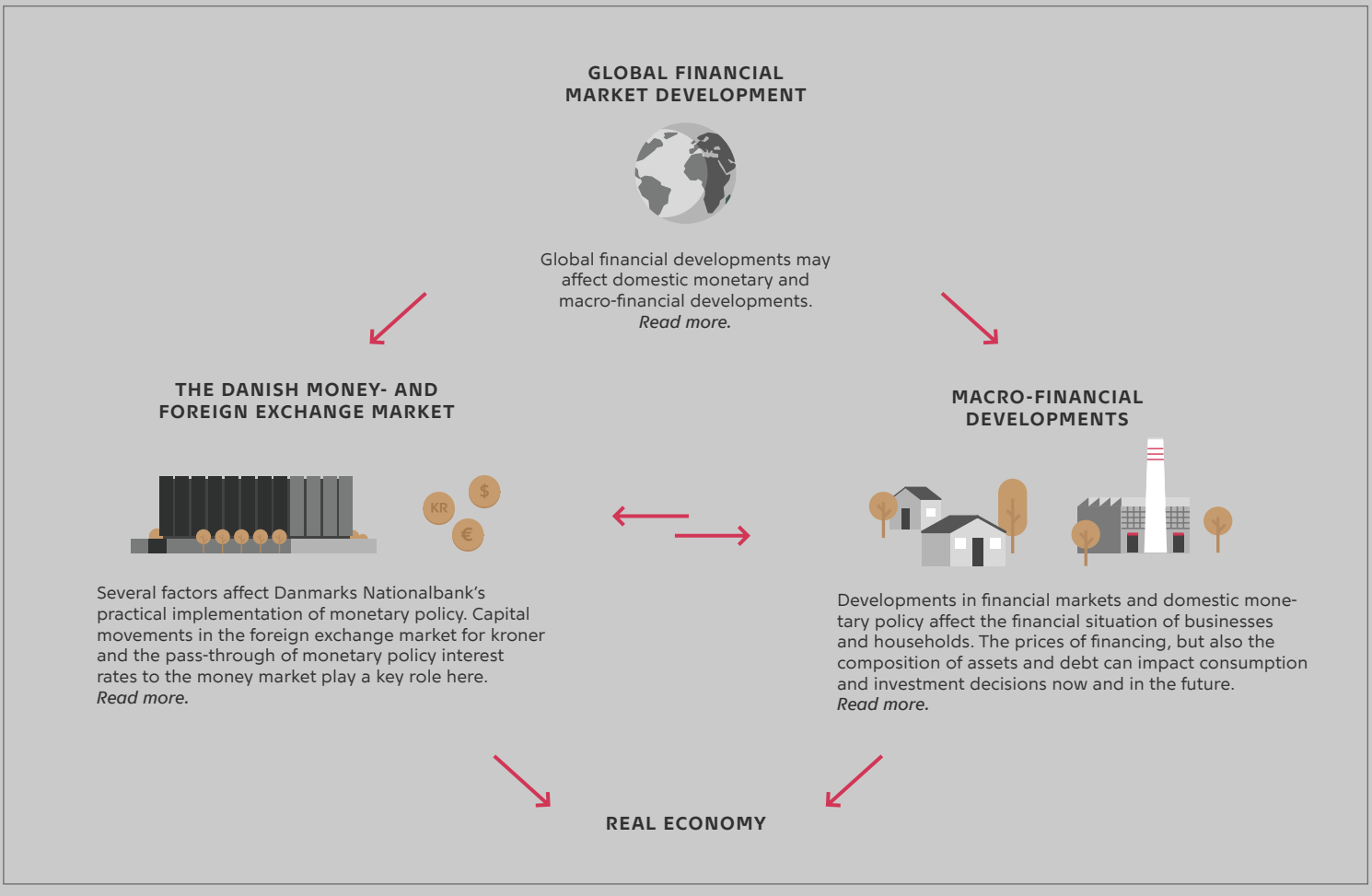
19 MACRO-FINANCIAL DEVELOPMENTS

30 APPENDIX

Danmarks Nationalbank publishes the *Monetary and financial trends* analysis twice a year.

The Danish fixed exchange rate policy means that monetary policy is tailored towards ensuring a stable krone exchange rate against the euro. Denmark is a small open economy and is closely integrated into the international financial system. Global financial developments can affect the demand for Danish kroner and thus the fixing of monetary policy interest rates by Danmarks Nationalbank. The fixed exchange rate policy also means that monetary policy in the euro area has a major impact on Denmark.

An important element of the analysis is the assessment of how the fixed exchange rate policy, in interaction with developments in the global financial markets, affects financial conditions in Denmark. The financial conditions are important for Danmarks Nationalbank's assessment of the current state of the Danish economy and the outlook for the future. Financial conditions also affect the potential build-up of macro-financial imbalances.



Global financial market development

Global financial markets have over the past six months been influenced by rising inflation as well as increased volatility stemming from Russia's invasion of Ukraine. Higher inflation has raised expectations of a tightening of monetary policy in, for example, the US and the euro area. Russia's invasion of Ukraine has brought soaring energy prices and thus further inflationary pressure. Model estimates point to market participants considering high future inflation as a larger risk now than in the years preceding the pandemic.

Higher expected inflation has led to higher expectations of increasing money market interest rates in the US and in the euro area among market participants. This has impacted money market rates in Denmark as a result of the Danish fixed exchange rate policy. At the same time, Danish government bond yields have increased in tandem with the German ones, and the long government bond yield spreads remain higher than before the covid-19 outbreak. However, with Russia's invasion of Ukraine comes a negative shock to the economy and, among other things, increased volatility.

Rising inflation and Russian invasion have set the agenda

Markets affected by persistent volatility and higher inflation during the past six months

Inflation has risen in the euro area and in the US since the beginning of 2021, see chart 1. Core inflation has risen more sharply in the US than in the euro area.[1] A greater increase in demand in the US compared to the euro area has led to bottlenecks in both goods and labour markets.[2] Russia's invasion of Ukraine has led to soaring energy prices and also, among other things, to a negative shock to economic activity.

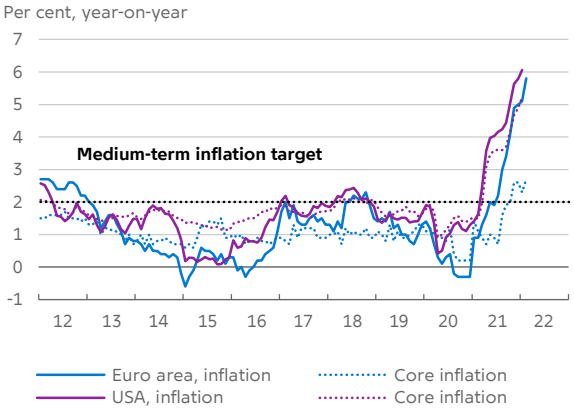
The higher inflation has been more persistent than initially anticipated in the market

In spring 2021, consensus among market participants was that the rise in inflation in both the euro area and in the US would be of a temporary nature. Further increases in inflation in autumn 2021 and winter 2022 have changed the perceived risk of future inflation. This is reflected, inter alia, in market-based inflation compensations, which can be split into market participants' expectation of future inflation and an inflation risk premium, see box 1. The medium-term inflation expectations have increased in the euro area and are approaching the European Central Bank's (ECB) 2 per cent medium-term target, see chart 2.

The risk assessment has shifted towards higher inflation and inflationary pressures

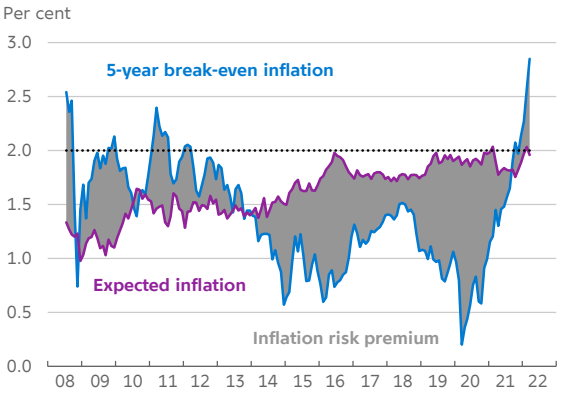
The inflation risk premium is a measure of the risk associated with the expected inflation. Since the end of the sovereign debt crisis in 2012, the 5-year inflation risk premium has been negative in the euro area. This means that market participants have been adding downside risks to future inflation in the medium-term during this period and thus expected inflation to be below the ECB's inflation target.

Inflation has increased in the euro area and in the US Chart 1



Note: Inflation calculated on the HICP index for the euro area and the PCE index for the US. The latest data points are January 2022 for the US and February 2022 for the euro area.
Source: Macrobond and Danmarks Nationalbank.

Inflation expectations close to the medium-term target Chart 2



Note: Market-based inflation compensations based on inflation swaps decomposed into expected inflation and an inflation risk premium, see box 1. The latest data point is 10 March 2022.
Source: Refinitiv Datastream and Danmarks Nationalbank.

1 Core inflation is an expression of underlying price pressures in the economy.

2 See Danmarks Nationalbank, War in Ukraine dampens growth and increases prices, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, no. 5, March 2022.

Estimation of market expectations and risk premia for government bond yields and inflation swaps

Box 1

The price of financial products typically reflects various elements, including market implied expectations for the future and various risk premia reflecting the risks associated with these products. Expectations may, for example, be for future earnings (equities), future interest rates (bonds) or future inflation (inflation swaps). Risk premia make it difficult, based on observable market prices, to infer an actual market implied expectation for future developments.

Term premia and expectations for future interest rates are of great interest to central banks when conducting monetary policy. For example, forward guidance primarily affects expectations for future monetary policy rates, whereas quantitative easing, such as the ECB's asset purchase programmes, particularly affects the term premium.[1]

Statistical models can be used to try to separate the two components and thus achieve a pure measure of the implicit market expectations for future developments. This box describes a method of deriving a premium for interest rate risk and inflation risk based on dynamic interest rate models, and thereby also obtain a measure of expectations for future interest rates as well as inflation.[2]

Term premia and expected short-term interest rates

The government bond yield curve is often used as an indicator of future monetary policy interest rate expectations, as government bonds are typically close to being risk-free. Since market participants in the economy are most often risk-averse, government bond yields not only reflect future short-term interest rate expectations, but also include a risk premium (denoted term premia) for assuming interest rate risk. For example, an *n*-year government bond yield can be decomposed as

$$y(n) = \frac{1}{12n}\sum_{i=0}^{12n} E[r_i] + TP(n),$$

where $y(n)$ is the government bond yield, $E[r_i]$ is the expected monetary policy interest rate in i month(s), and $TP(n)$ is the term premium for the n-year government bond. The model, a dynamic non-arbitrage model, uses zero-coupon government bond yields with maturities of between 6 months and 10 years. The model is estimated for both Danish and German government bond yields.

Inflation risk premia and inflation expectations

Similarly, the inflation swap curve can be used as an indicator of future inflation rates. The market-based inflation compensations[3] similarly include an expectation part (of average future inflation) and a risk premium for exposing oneself to future inflation uncertainty (denoted the inflation risk premium). The market-based inflation compensation in *n* year(s) can thus be decomposed as

$$ILS(n) = \frac{1}{12n}\sum_{i=0}^{12n} E[\pi_i] + IRP(n),$$

where $ILS(n)$ is the market-based inflation compensation in *n* year(s), $E[\pi_i]$ is the expected inflation in i month(s), and $IRP(n)$ is the inflation risk premium in the *n*-year point on the inflation swap curve. The estimation is based on inflation swap at-par interest rates with a maturity of 1-10 years.[4]

Economic theory points out that the inflation risk premium is typically positive during times of high economic growth and risk of overheating, and is similarly negative during times of low economic activity.

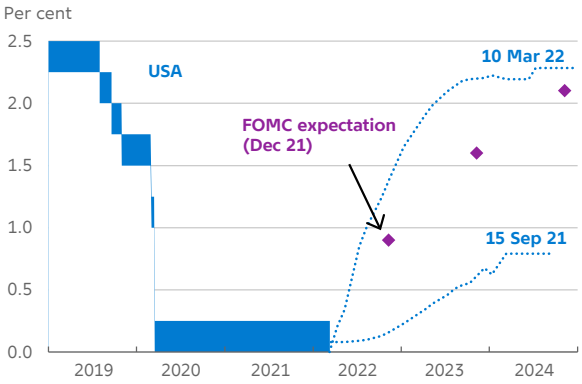
1. See, for example, Eser et al., Tracing the impact of the ECB's asset purchase programme on the yield curve, *ECB Working Paper*, no. 2293, July 2019.
2. A dynamic affine no-arbitrage model is used, estimated by the method in Joslin et al. (2011), A New Perspective on Gaussian Dynamic Term Structure Models, *Review of Financial Studies*, Vol. 24., Issue 3, pp. 926-970, for the nominal yield curve and the inflation swap curve. In addition, the estimation of the model uses the method in Gonzalo Camba-Mendez and Thomas Werner, The inflation risk premium in the post-Lehman period, *ECB Working Paper*, no. 2033, March 2017.
3. Or inflation swap rates.
4. Maturities of 1 to 10 years have the highest market liquidity, see Derivatives transactions data and their use in central bank analysis, *ECB Economic Bulletin*, Issue 6, 2019.

The inflation risk premium increased significantly in 2021 and is positive for the first time since 2013.[3] The positive risk premium related to future inflation indicates that market participants no longer view low inflation as the primary risk scenario. The market participants' expectations are in line with developments in survey-based measures of inflation expectations for the euro area.[4,5]

Interest rate hikes and expectations of more hikes, e.g. in the US

Against the backdrop of the surge in inflation in the US, an increasing pace of monetary policy tightening in the US is expected by market participants. At present, market participants are expecting a 25 basis point increase in the Federal Funds rate to be approved at the next policy meeting on 16 March and about 4 more rate hikes during the rest of 2022, see chart 3. Following Russia's invasion of Ukraine, market participants' expectations of money market rates declined slightly in the US. However, the development in the expectations has reversed most recently. By comparison, in early October market participants were only expecting a single interest rate hike in 2022.

Expectations of more rate hikes from the Fed during 2022 Chart 3



Note: Expectations related to the Federal funds rate from the FOMC meeting in December 2021. Dashed lines indicate market-implicit expectations for money market interest rates in the US.
Source: Macrobond, Thomson Reuters, Scanrate Rio and Danmarks Nationalbank.

Prospect of gradual tightening of monetary policy in the euro area

In the euro area, the withdrawal of monetary policy stimuli is likely to be more gradual than in the US due to lower underlying price pressures. At the March monetary policy meeting, the European Central Bank maintained the deposit facility rate of -0.5 per cent. This must be seen, among other things, in the context of the ECB's adjusted forward guidance from July 2021, which provided details on a number of conditions that must be present for a rate hike to take place. Among other things, inflation must durably reach 2 per cent before the end of the projection horizon. In addition, the ECB has announced that interest rates will not be raised until the net purchases under the asset purchase programme (APP) have been phased out. The governing council of the ECB reduced the pace of APP purchases for the second quarter 2022. The governing council expects to end net purchases under the APP in the third quarter, as long as data support its expectation of no weakening in the projected inflation in the medium term, even after its net purchases have finished. The ECB's net bond purchases under the pandemic emergency purchase programme (PEPP) will be discontinued from end-March. Market participants expect the ECB to on average hike its monetary policy rate by about 50 basis points over the course of 2022, see chart 4.

Danish money market rates have followed developments in euro area

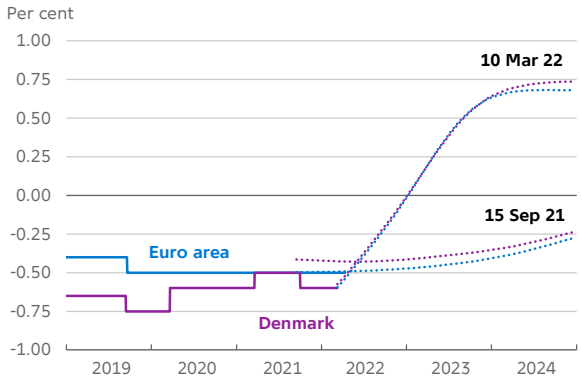
The market implied expectations of increasing money market rates in the euro area have had spill-over effects

3 This is consistent with the ECB's latest assessment, see *ECB Economic Bulletin*, Decomposing market-based measures of inflation compensation into inflation expectations and risk premia, no. 8, 2021.

4 See Danmarks Nationalbank, War in Ukraine dampens growth and increases prices, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, no. 5, March 2022.

5 Survey-based inflation expectations based on the ECB's Survey of Professional Forecasters, SPF, and the Survey of Monetary Analysts, SMA, also point towards increasing consensus on inflation of around 2 per cent in the euro area over the next few years.

Prospect of a gradual tightening of monetary policy in the euro area Chart 4



Note: Dashed lines indicate market-implicit expectations for money market interest rates in the euro area and in Denmark measured in terms of 3-month implied forward interest rates.
Source: Thomson Reuters, Scanrate Rio and Danmarks Nationalbank.

Geopolitical tensions have added to equity market volatility in 2022 Chart 5

Note: Realised volatility for S&P500 (US), OMXC20 (Denmark) and Eurostoxx (euro area) estimated using a realised kernel estimator. The latest data point is 10 March 2022.
Source: Danmarks Nationalbank.

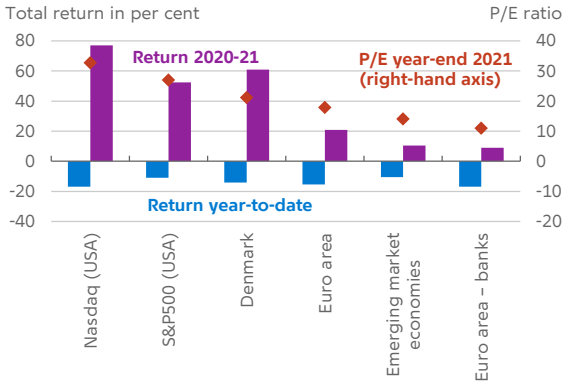
on expectations for Danish money market rates via the fixed exchange rate policy, see chart 4. That has increased Danish market rates. Danmarks Nationalbank unilaterally cut the monetary policy interest rate by 10 basis points with effect from 1 October 2021 following an increased krone demand, see the *Danish money market and foreign exchange market* section. Following the cut, the shortest money market rates in Denmark and in the euro area have largely coincided.

High volatility and declining equity prices

The prospect of a tightening of monetary policy, along with geopolitical uncertainty related to Russia's invasion of Ukraine, has led to increased volatility in the equity markets, among other things, see chart 5. In the days leading up to the Federal Open Market Committee (FOMC) meeting on 26 January, a significant increase in volatility was observed in the S&P500 US stock market index, which also had spill-over effects on European and Danish equities. During February, the time leading up to the Russian invasion of Ukraine was characterized by a high degree of volatility especially in the euro area and in Denmark.

In addition to high volatility, the beginning of 2022 has been marked by equity price declines, see chart 6.

Falling equity prices in 2022 Chart 6



Note: The P/E ratio measures the ratio of pricing to current earnings. The latest data point is 10 March 2022.
Source: Refinitiv Eikon.

The declines have taken place in the wake of substantial increases in the 2020-21 period, which was characterised by economic recovery in the advanced economies after the covid-19 pandemic. Prior to the Russian invasion, the declines had been particularly pronounced in the markets and market segments that had seen the greatest price increases over the past two years and with the highest price-to-earnings ratios.

Russia's invasion of Ukraine has affected equity prices differently across industries

The European equities have declined further following the Russian invasion of Ukraine on 24 February 2022. This should be viewed in the light of increasing prices on energy and commodities, which among other things have implied higher production costs now and larger uncertainty regarding future production costs, in particular for firms in production-intensive industries such as manufacturing and cyclical consumption. Bank equities may have been affected by uncertainty regarding their direct and indirect exposure to Russia and Eastern Europe, along with a risk of a drop in their earnings due to the economic effects stemming from the invasion. European equity prices in these industries have thus declined significantly more than in other industries since the invasion started on 24 February 2022, see chart 7. This may be because investors have downgraded their central estimates for the future earnings of these companies, but also because they require a higher risk premium due to greater uncertainty about the future business model.

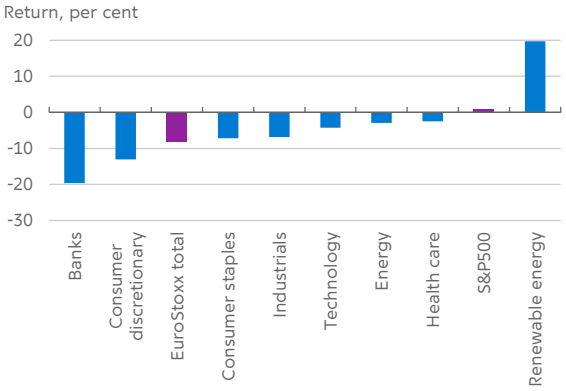
Equity prices of companies in less cyclical and capital-intensive industries such as healthcare, stable consumption and technology have declined less than the European equity market as a whole. The Russian invasion of Ukraine has also given rise to an increased focus on cutting the reliance on Russian energy, including natural gas, among other things. The prospect of a faster transition from fossil fuels to renewable energy has increased equity prices of companies operating within renewable energy and related technological solutions, see chart 7. Eastern European equity markets have also been characterised by declining prices, cf. Box 2.

Higher government bond yields reflect expected increase in short-term interest rates

Long-term government bond yields in the euro area and in the US have been characterised by increases and significant volatility in early 2022. Thus, the 10-year German government bond yield is up by 46 basis points since September 2021, while the yield on US government bonds has increased by 50 basis points over the same period.

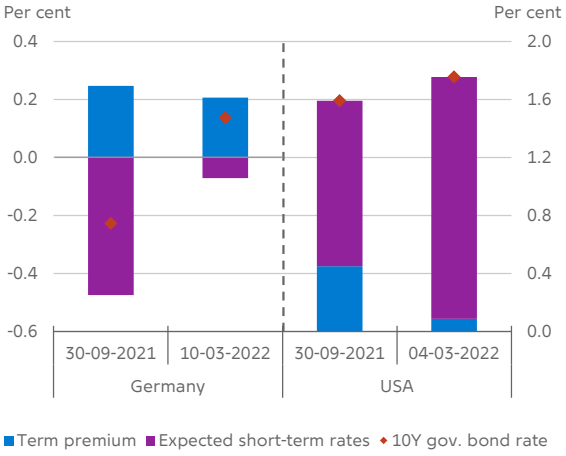
The development in long-term interest rates can be ascribed partly to expectations as regards future short-term interest rates, and partly to the development in a term premium. The term premium reflects the risk compensation demanded by investors for

The Russian invasion has affected equity markets in different ways Chart 7



Note: Return on equities across industries in the leading European stock index, Euro Stoxx and the US S&P500 index. The return is calculated from 23 February 2022 up to and including 10 March 2022. Renewable energy is based on companies in iShares Global Clean Energy UCITS ETF.
Source: Bloomberg, Refinitiv Datastream and Danmarks Nationalbank.

Increase in long-term interest rates reflects expected increase in monetary policy rates Chart 8



Note: Calibrated zero coupon rates of 10-year government bonds. Interest rates are decomposed using the method described in box 1.
Source: Macrobond and own calculations.

Russia's invasion of Ukraine has led to falling equity prices and interest rate increases in the surrounding countries

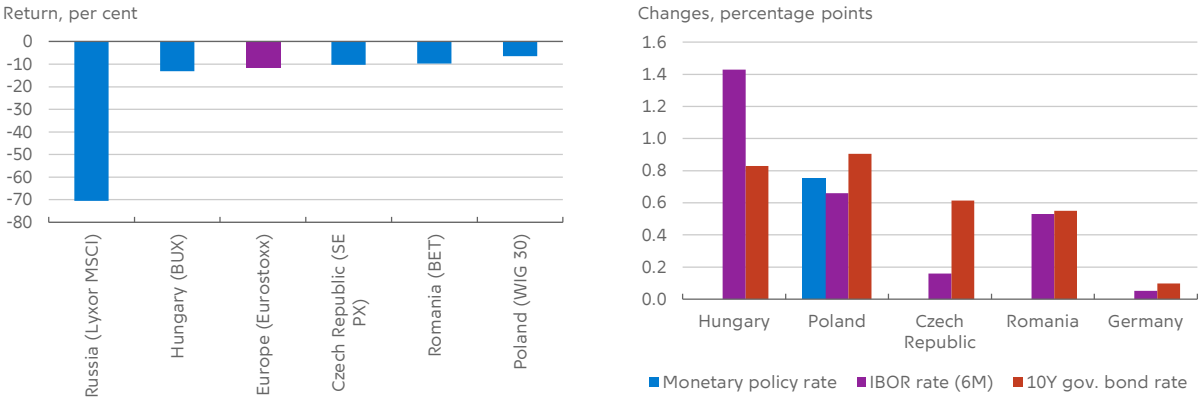
Box 2

The Russian invasion of Ukraine has, in addition to severe human costs, also led to significant fluctuations in the financial markets in the surrounding areas. The invasion has caused large declines in the stock markets in most of Eastern Europe, see chart (left). Russian equities have been hit the hardest with average price declines of around 70 per cent since the invasion on 24 February 2022.[1] In comparison, the leading stock indices in Romania, Hungary, the Czech Republic and Poland have fallen by approximately 10 per cent, which is broadly in line with the decline in the European Eurostoxx index.

Along with declining equity prices, the Russian invasion of Ukraine has also led to increases in money market rates and government bond yields in the surrounding countries, see chart (right). The rise in short-term interest rates, including the monetary policy rate hike in Poland, should be viewed primarily in the light of the fact that Russia's invasion of Ukraine has reinforced an already strong inflation dynamic. For example, inflation figures for the Czech Republic and Poland were 11 and 9 per cent, respectively, on an annual basis even before the rise in commodity prices following the invasion. The increase in government bond yields is also partly due to higher perceived credit risk, which is supported by the increase in credit default swaps spreads, CDS.[2] The economies of Eastern European countries are more dependent on the developments in Russia's economy than the Danish economy, where direct exposure to Russia is relatively limited, measured both in terms of trade and financial integration.[3]

The market for Russian government bonds has been closed since 25 February 2022. The company Gazprom, which is the world's largest producer of natural gas and Russia's largest company in terms of turnover, and which is partly owned by the Russian government, has outstanding corporate bonds in e.g. US dollar. The yield on these bonds has risen from approximately 5 to 30 per cent following the invasion. The sharp rise in interest rates and the falling equity prices in Russia indicate the seriousness of the situation, also for the Russian economy.

Falling equity prices and increasing interest rates faced by nearby countries in the wake of the Russian invasion



Note: Left: Returns in the leading stock price indices for the countries concerned from 23 February 2022 to 10 March 2022. For Russia, the price of the Lyxor MSCI ETF is used, which is calculated in euros, as trading on the Russian stock exchange has been closed down since 25 February 2022. Right: Changes from 23 February 2022 to 10 March in monetary policy interest rates, 6-month IBOR interest rates and 10-year government bond rates for the countries concerned.
Source: Refinitiv Datastream, Bloomberg and Danmarks Nationalbank.

1. Recent developments in the Russian stock market are associated with some uncertainty, as trading on the Russian stock exchange has been closed since February 25, 2022. Therefore, the price of international ETFs designed to follow the Russian stock market is used as an indication of the current development in the market value of Russian equities.
2. A CDS is a derivative financial product that can be used to insure against losses on the underlying bond in case of a credit event, e.g. a state bankruptcy.
3. Denmark's financial assets directly invested in Russia and Ukraine constitute 0.2 and 0.1 per cent, respectively, of Denmark's total financial assets in January 2022, when indirect exposures are disregarded. See (*link*).

holding long-term bonds rather than rolling over a series of short-term bonds over the same period. Model calculations indicate that the rising long-term government bond yields are primarily attributable to expectations of a future increase in short-term interest rates, see chart 8. In Germany and the US, the term premium has declined, probably against the backdrop of Russia's invasion of Ukraine and the market response to it.

US short-term government bond yields have risen significantly in the past six months and faster than long-term government bond yields. The significant increase in short-term yields reflects market expectations of an early and rapid tightening of monetary policy in the US. The short end of the German government bond yield curve has risen less than in the US, as market participants expect the ECB to hike policy rates at a slower pace than the Fed over the next few years, see chart 4.

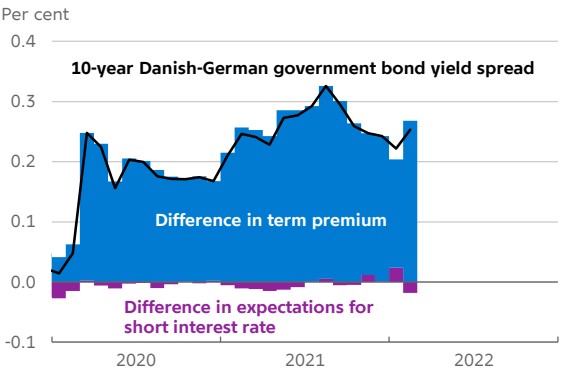
Yield spread to Germany driven by higher term premia in Denmark compared to Germany

Market expectations of future short-term interest rates, and thereby of future monetary policy, are similar in Denmark and Germany due to the Danish fixed exchange rate regime.

However, the 10-year government bond yield spread between Denmark and Germany remains wider than before the covid-19 outbreak. Danmarks Nationalbank's term structure models indicate that the positive government bond yield spread since the covid-19 outbreak is primarily due to an increase in the term premium for Danish government bonds relative to German bonds, see chart 9.

The higher Danish term premium reflects, among other things, a jump in the duration of Danish mortgage bonds during 2021, see the *Macro-financial developments* section. The duration jump has contributed to reducing institutional investors' demand for other bonds with longer maturity, such as government bonds.[6] In this way, duration jumps in the mortgage bond market can lead to increasing government bond yields.

Widened Danish-German government bond yield spread is due to higher Danish term premium Chart 9



Note: The government bond yield spread is decomposed using two yield models for Danish and German bonds, see box 1. The yields are estimated 10-year zero coupon rates. The latest data point is 28 February 2022.
Source: Danmarks Nationalbank.

6 See Achord et al., Domestic bond portfolio adjustments during duration jumps, *Danmarks Nationalbank Economic Memo*, no. 10, December 2021.

The Danish money- and foreign exchange market

The Danish krone has been on the strong side of the central parity rate for the past two years. Rising global uncertainty following Russia's invasion of Ukraine has not affected the krone rate significantly. Effective from 1 October 2021, Danmarks Nationalbank independently reduced the policy interest rates by 10 basis points, which was quickly and efficiently transmitted to money market rates and helped to avoid a further strengthening of the krone.

December 2021 saw a strong krone demand, and Danmarks Nationalbank bought kr. 47 billion worth of foreign exchange. The demand was mainly driven by a substantial decline in short-term euro interest rates towards the turn of the year, temporarily making it more attractive to hold kroner. After the turn of the year, the krone has weakened moderately. The krone rate remains on the strong side of the central parity rate.

Temporary factors boosted demand for Danish kroner in December

Rising global uncertainty has not impacted the Danish krone market

The krone exchange rate against the euro has been on the strong side of the central parity rate since spring 2020, see chart 10. In the first months of 2022, the krone has weakened slightly. This is ascribable, among other things, to a strong temporary krone demand in December 2021, which was reversed after the turn of the year, see below and box 5. In addition, US equity prices have declined in 2022, see the *Global financial market development* section. The krone demand of Danish pension funds usually declines in the context of falling US equity prices. That is due to a fall in the pension funds' USD exposure when prices in the US equity market decline, which reduces the demand for kroner for foreign exchange hedging purposes.[7]

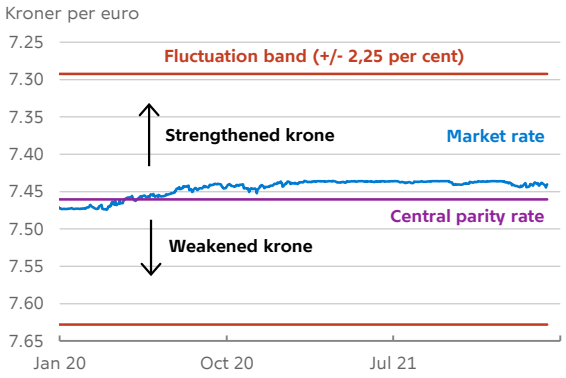
The Danish krone has not been significantly affected by the geopolitical uncertainty related to Russia's invasion of Ukraine. However, it has led to investors withdrawing from Eastern European currencies and seeking safe havens, see box 3.

Interventions and interest rate cut in 2021

The krone demand was strong during several periods of 2021, and interventions by Danmarks Nationalbank to prevent a further strengthening of the krone included FX purchases as well as an independent reduction in the policy interest rates by 10 basis points effective from 1 October, see chart 11.

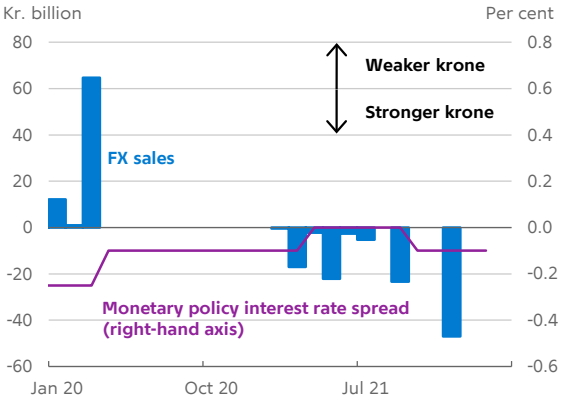
The adjustments involved reducing the current account, certificates of deposit and lending rates. Transmission to the short day-to-day reference rate in Danish kroner, the T/N rate, was quick and effective, see chart 12. Danish CITA swap rates, which are based on the T/N rate, have generally been close to Danmarks Nationalbank's lending rate since the outbreak of the pandemic in March 2020.

The Danish krone remains strong against the euro Chart 10



Note: Krone rate against the euro. Reverse y axis. The latest data point is 10 March 2022.
Source: Refinitiv Datastream.

Danmarks Nationalbank has intervened to prevent further strengthening of the krone Chart 11



Note: The narrowing of the monetary policy interest rate spread in March 2021 was due to the technical adjustment of Danmarks Nationalbank's monetary policy instruments and does not reflect an independent interest rate hike. The latest data point is February 2022.
Source: Danmarks Nationalbank and Refinitiv Datastream.

7 See Danmarks Nationalbank, Accommodative financial conditions strengthen the upswing, *Danmarks Nationalbank Analysis (Monetary and financial trends)*, no. 23, September 2021.

Investors have withdrawn from Eastern European currencies and sought safe havens

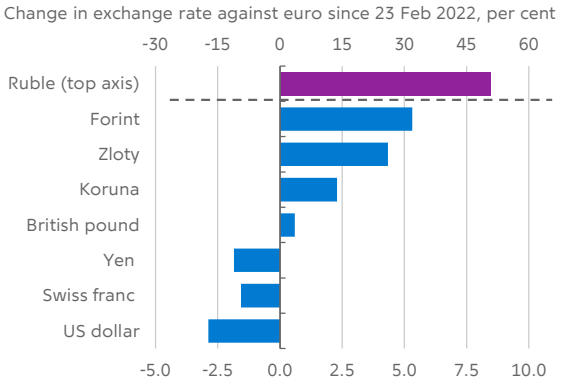
Box 3

Russia's invasion of Ukraine has given rise to significant exchange rate fluctuations among different currencies. The value of the Russian ruble has dropped significantly, and the exchange rate against the euro has more than halved since the Russian invasion of Ukraine on 24 February 2022. This reflects the extensive sanctions against Russia, including the trade restrictions imposed by the US and UK against Russian oil, which significantly reduce global trade with Russia and which, at the same time, have led to large capital outflows from Russian assets. Both factors reduce the demand for rubles. In addition, the Russian central bank's ability to defend the ruble is limited given that a large part of the central bank's foreign exchange reserve is frozen in Western countries. To counteract the decline in the ruble, the Russian central bank has, among other measures, raised the benchmark monetary policy rate from 9.5 per cent to 20 per cent and made it mandatory for Russians to sell 80 per cent of their income from international trade to the central bank against rubles.

The currencies of other Eastern European countries have also declined significantly. The Polish zloty and the Hungarian forint have declined around 5 per cent against the euro since 24 February, while the Czech koruna has also weakened, see chart. The declines have occurred despite the fact that the Czech and Polish central banks have carried out currency interventions and, additionally, that Poland has raised the monetary policy rate, see box 2. The declining exchange rates reflect the fact that these countries are economically and financially more closely integrated with Russia and Ukraine than the rest of Europe.

The euro has weakened against other major currencies, including the US dollar, see chart. In addition to the invasion taking place in Europe, this also reflects that investors have sought safe havens such as the dollar, the yen and the Swiss franc, which typically increase in value when global uncertainty increases.[1] Demand for safe assets is also seen in other markets, as the price of gold, among other things, has increased since Russia invaded Ukraine.

Eastern European currencies have declined, and investors are looking for safe havens



Note: Change in exchange rates against the euro since Russia's invasion of Ukraine from 23 February 2022 to 10 March 2022.
Source: Refinitiv Eikon.

1. See Linda S. Goldberg and Signe Krogstrup, International capital flow pressures, *National Bureau of Economic Research*, no. w24286, 2018.

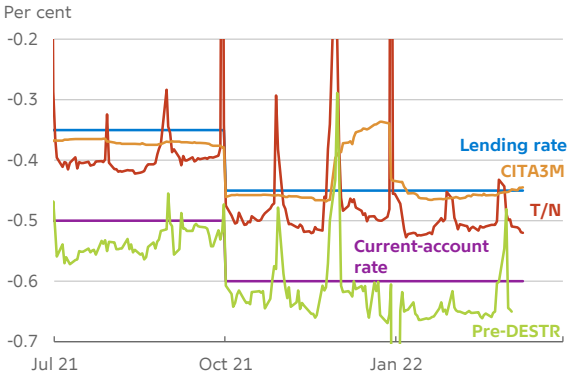
Interventions have boosted banks' net position, while state finances have pulled in the opposite direction

Viewed in isolation, Danmarks Nationalbank's FX market interventions in the form of foreign exchange purchases against selling Danish kroner in 2021 increased the banking sector's net position[8] by kr. 120 billion. At the same time, an increase in the central government's account with Danmarks Nationalbank reduced the banks' overall net position. The current level is slightly lower than before March 2020, see chart 13.[9]

Changed distribution of the net position has pulled T/N rate closer to the lending rate

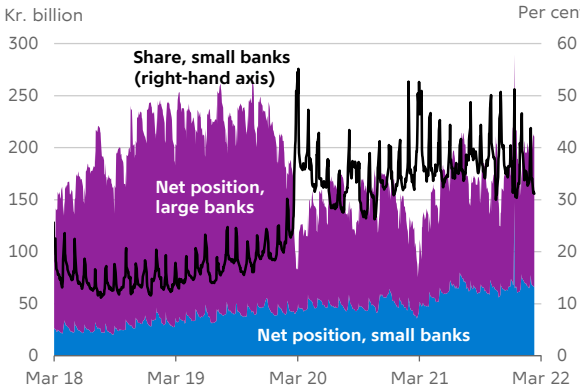
The smaller banks hold a larger share of the net position compared to the pre-March 2020 period, see chart 13. This is explained by an increasing deposit surplus among the smaller banks, which they have been more inclined to deposit in Danmarks Nationalbank than the large banks due to their relatively simple liquidity management, see appendix.[10] The higher share held by smaller banks is believed to have contributed to the T/N rate being closer to Danmarks Nationalbank's lending rate compared to the pre-covid-19 period. This is because of the smaller banks' relatively low money market activity. This means that the supply of liquidity in the money market is more scarce than what would be implied by the aggregate net position, which, in isolation, increases the T/N rate. Danmarks Nationalbank has set up a theoretical model indicating that the changed distribution of the net position in the direction of the smaller banks holding a larger share hereof has increased the T/N rate by an average of about 3 basis points, see appendix. The model indicates that a net position increase will tend to slightly reduce the T/N rate, which is consistent with actual observations, see chart 14.

Transmission of the rate cut has been effective Chart 12



Note: Denmark Short-Term Rate (DESTR) is a short transaction-based reference rate for the Danish krone market, see box 4. Developments in the T/N rate and pre-DESTR reflect fluctuations associated with month-end effects, meaning banks are less willing to provide loans and therefore require a higher interest rate. The latest datapoint is 10 March 2022 except for Pre-DESTR, for which the latest datapoint is 4 March 2022.
Source: Danmarks Nationalbank.

Small banks hold a larger share of net position Chart 13



Note: The net position indicates the total net deposits of banks with Danmarks Nationalbank. 'Large banks' are banks reporting to Danmarks Nationalbank's money market statistics and their consolidated mortgage credit institutions. The following banks are included: Danske Bank, Nordea, SEB, Spar Nord, Jyske Bank, Nykredit Bank, Sydbank, Handelsbanken, Arbejdernes Landsbank and Sparekassen Kronjylland. 'Small banks' are the remaining monetary policy counterparties, comprising most of the remaining Danish banks and mortgage credit institutions.
Source: Danmarks Nationalbank and own calculations.

8 The net position is the sum of the banks' net deposits with Danmarks Nationalbank.

9 The government's financing requirement was kr. 100 billion lower in 2021 than expected at the start of the year. Against this background, the balance of the central government's account with Danmarks Nationalbank is substantially higher than before the pandemic.

10 See Danmarks Nationalbank, Accommodative financial conditions strengthen the upswing, *Danmarks Nationalbank Analysis (Monetary and financial trends)*, no. 23, September 2021.

New transaction-based day-to-day reference rate, DESTR, to be launched on 1 April

Box 4

DESTR (Denmark Short-Term Rate) is the new transaction-based day-to-day reference rate in the Danish krone market. Danmarks Nationalbank announced in November 2021 that DESTR will be launched on 1 April 2022 and subsequently be available for use in financial contracts.

In the future, the T/N rate will be determined as DESTR plus a fixed spread adjustment

Since January 2021, a working group appointed by Danmarks Nationalbank has been working to plan the transition from the existing the current reference rate, the T/N rate, towards DESTR. As recommended by the working group, after the launch of DESTR, the T/N rate will be calculated as DESTR plus a fixed spread adjustment. The spread will be announced on 25 March 2022 at the latest and will be calculated as a simple average of the T/N rate/DESTR spread during the period 19 March 2021 to 21 March 2022. Following a transitional period, the T/N rate will be definitiely phased out on 1 January 2026.

Danmarks Nationalbank recommends that all market participants start using DESTR as their reference rate in financial contracts, discount curves, account rates etc. as soon as possible following the launch of DESTR.

DESTR follows Danmarks Nationalbank's certificates of deposit rate closely

During the second half of 2021 and the start of 2022, DESTR has on average been of about 3 basis points below the current account and certificates of deposit rates, see chart 12. The difference reflects, among other things, the fact that DESTR is a deposit rate. Like other money market rates, DESTR was affected by year-end effects, see box 5.

Strong interest rate pass-through to the new reference rate

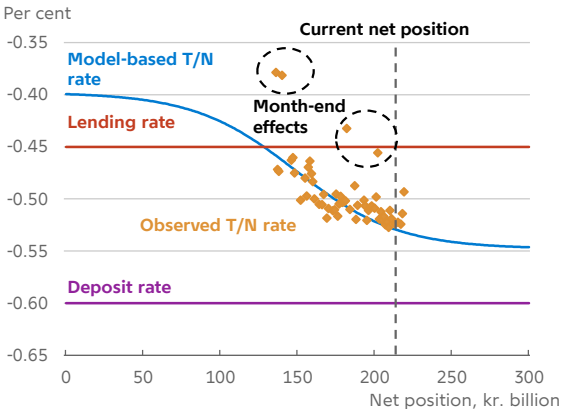
The policy interest rate reduction also passed through completely to the Danish Short-Term Rate (DESTR) launched as a new day-to-day-reference rate on 1 April 2022. From this date, DESTR will be available for use in financial contracts. Preliminary calculations of DESTR show that it is close to Danmarks Nationalbank's certificates of deposit rate. Following the launch of DESTR, the T/N rate will be DESTR plus a fixed spread adjustment to be announced on 25 March 2022 at the latest, see box 4.

Interventions in December 2021 were primarily driven by temporary factors

Immediately following Danmarks Nationalbank's interest rate cut on 1 October 2021, the Danish krone weakened. In the period up until the end of the year, krone demand rose again, and Danmarks Nationalbank intervened by buying kr. 47 billion worth of foreign exchange in December 2021. The strong krone demand was driven, in particular, by substantial declines in market rates for short euro positions around the turn of the year (year-end effects). That was the case, for example, for T-bills and other short-term bonds maturing after the end of the year.

Model calculations are consistent with observed T/N rates

Chart 14



Note: Model-based T/N rate is calculated on the basis of a T/N rate pricing model, see appendix for details. The model calculations are based on current monetary policy rates last changed on 1 October 2021. The observed T/N rates and net position figures, i.e. figures for the sum of the banks' deposits with Danmarks Nationalbank, are also based on data from 1 October 2021 onwards.
Source: Own calculations.

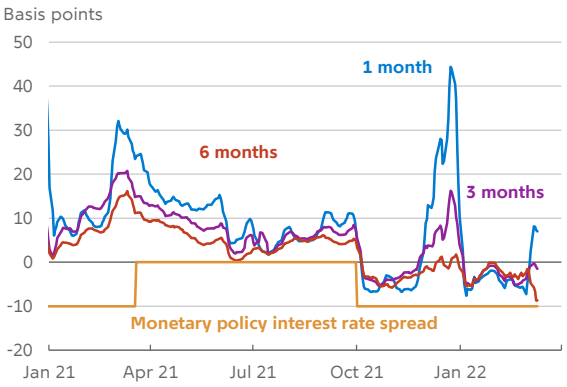
The same was true for repo agreements[11] involving the arrangement of loans using bonds as collateral over a set period of time.

The repo rate for loans extending into the new year fell significantly towards the end of the year. The year-end effects were greater than in previous years, see box 5. This may have to do with the ECB's increasing portfolio of euro government bonds, which are typically used as collateral in repo agreements. A lower supply of government bonds available to private parties makes repo deposits more expensive, resulting in falling repo rates. For example, the falling euro interest rates meant that buying krone assets and retaining them until the new year was more attractive than holding euros.

In the forward exchange market, there were also signs of a temporary increase in krone demand. The implied forward spread[12] between kroner and euro increased significantly in December 2021, see chart 15. This reflects an increased demand for borrowing in kroner against collateral in euros. Although this does not in itself affect the spot market between kroner and euros, it may increase krone demand, see box 5.

The forward spread between kroner and euro rose significantly towards the end of the year

Chart 15



Note: The implicit spread between kroner and euros in the forward exchange market. The latest data point is 10 March 2022.
Source: Refinitiv Eikon.

11 Which is the equivalent of a party selling a bond to a counterparty today and committing to buy back the same bond at a future date.

12 The forward spread is the implicit spread involved in entering into a contract for the forward purchase of kroner against euros.

Year-end effects in European repo rates made it attractive to hold Danish kroner around the turn of the year

Box 5

Financial regulation means European banks demand compensation for repo deposits around year-end

Banks in the 21 EU countries participating in the European Single Resolution Fund must pay contributions towards the building-up of the fund based on the sizes of their balance sheets on the last business day of the year. Contributions to the fund have been increasing following the increases in (covered) deposits held by the participating banks during the covid-19 period. The deposits are used to calculate the size of the fund once fully built up at the end of 2023. Moreover, the size of banks' balance sheets on the last business day of the year has implications for a number of financial ratios, including the leverage ratio. This means that banks may want to reduce their business volume on the final business day of the year.

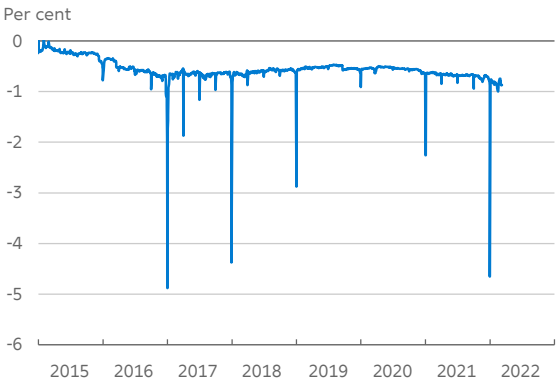
As repo deposits, for example, inflate balance sheets, the banks demand additional compensation to accept repo deposits around the turn of the year. This is reflected in the decline in European day-to-day repo deposit rates around the turn of the year, see chart A. These year-end effects were greater in 2021 than in previous years and on a scale similar to 2016, which was when contributions to the Single Resolution Fund started. This may have to do with the increasing contributions to the fund and also a decline in the free float of government bonds due to the ECB's unconventional monetary policy, see below.

Low supply of collateral may have caused repo rates to plunge in 2021

A repo contract entails the provision of collateral for the loan, typically in the form of government bonds. The supply of government bonds therefore has a bearing on the overall repo capacity and thus also on repo rates. The ECB's government bond purchases under the PEPP and PSPP programmes have reduced the amount of government bonds available to private parties. As has the large volume of T-LTRO lending backed by government bonds.[1] The reduced amount of available bonds may have contributed to German day-to-day repo rates falling to more than 30 basis points below the ECB's deposit rate during the 4th quarter of 2021, and to more pronounced year-end effects than in previous years.

...to be continued

Chart A: German day-to-day repo rates plunged around the turn of the year



Note: German government bond repo rates based on RFR Euro benchmark index. Repo rates are day-to-day (overnight). Repo rates are a measure of the effective cost of overnight financing backed by the respective countries' government bonds.
Source: Macrobond.

1. For further discussion of the impact of unconventional monetary policy on collateral, see Manmohan Singh, Collateral Reuse and Balance Sheet Space, *IMF Working Paper*, no. 17/113, May 2017.

Year-end effects in European repo rates made it attractive to hold Danish kroner around the turn of the year

Box 5

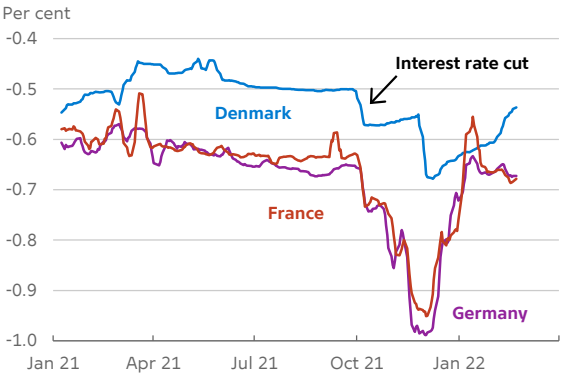
... continued

The importance of available collateral is emphasised by the fact that the ECB increased the limit for the lending facility under which bonds held by the ECB can be borrowed against cash from 75 to 150 billion euros on 1 December 2021. This increased the availability to private parties of government bonds, and partially counteracted the fall in repo rates.

Kroner made more attractive by the decline in euro interest rates

The lower repo rates meant that investors found alternatives for their euro liquidity around the turn of the year. French and German 3-month T-bill yields started falling as early as October 2021, and by early December they were close to -1 per cent, making it attractive to sell euro assets and buy other currencies, including Danish kroner. This is reflected, for example, in a significant increase in the yield spread between Danish and European T-bills, see chart B. For example, an investor could buy a Danish T-bill and finance the purchase by selling euros against kroner in the spot market. Alternatively, the investor could finance the purchase of a Danish T-bill by borrowing kroner against euro collateral via the foreign exchange market. This does not in itself affect the krone/euro spot price, but derived effects caused by the change in the price of hedging currency exposures may arise. In December, it became more expensive for euro investors to hedge kroner, while Danish investors conversely gained by hedging euro exposures. Both may have contributed to the increased krone demand.

Chart B:
T-bill yields in kroner became relatively attractive towards the turn of the year



Note: 3-month T-bills (generic benchmark).
Source: Refinitiv Eikon and Datastream.

Macro-financial developments

Financing costs have risen over the past six months on the back of higher market rates and falling equity prices. Market participants' expectations for medium-term inflation have risen over the same period, keeping risk-free real interest rates at low levels. The cost of debt financing has risen, especially due to increasing mortgage bond rates across most loan types.

Household borrowing has been moderate for an extended period. During the covid-19 pandemic, house prices have risen significantly, increasing home equity for homeowners and driving up borrowing needs for new homeowners. The credit growth has been driven primarily by new homeowners, while existing homeowners have utilised additional borrowing only to a limited extent on the back of the increases in home equity. Companies' use of equity and debt financing has increased in step with the reopening of the economies following the covid-19 pandemic. At the same time, the cost of equity financing has increased especially in 2022 as a result of falling equity prices.

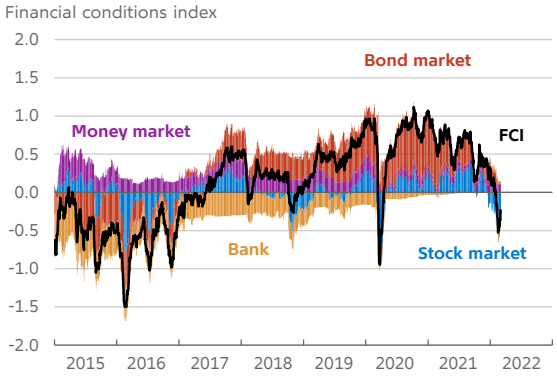
Financing conditions have been tightened in 2022

Financing costs have risen from a low level

Long-term mortgage bond rates have generally been rising since early 2021 and increased sharply in 2022. This was triggered by the increase in, inter alia, government bond yields, see the *Global financial market development* section, as well as an increasing risk premium compared to government bonds, see below. Since early February 2022, short-term mortgage rates have also risen. This has increased household financing costs, which consist primarily of mortgages. Towards the end of February, Russia's invasion of Ukraine and the geopolitical turmoil this has created gave rise to a slight decline in interest rates along the yield curve. The decline has however been reversed following the monetary policy meeting in the ECB in March.

Companies have a significant portion of their debt as variable-rate loans or with short term interest rate fixings. The interest expenses on firms' debt financing have, consequently, remained largely unchanged up until the beginning of February, and can rise to the extent that market participants' expectations of a tightening of monetary policy materialize. Equity prices have generally fallen since the beginning of the year, and this decline has accelerated further in certain industries, following Russia's invasion of Ukraine at the end of February. This is reflected in a higher equity risk premium, increasing the cost of equity financing for companies in 2022. Overall, market developments have thereby contributed to tighter financing conditions during 2022, although from a low level, see chart 16.

Tighter financing conditions during the past six months Chart 16



Note: Daily index. The latest data point is 10 March 2022. See Danmarks Nationalbank, Accommodative financial conditions strengthen economic upswing, *Danmarks Nationalbank Analysis (Monetary and financial trends)*, no. 23, September 2021.
Source: Danmarks Nationalbank, Refinitiv Eikon and Datastream, Nykredit and own calculations.

Real interest rates remain low

Against the backdrop of current inflation expectations, the risk-free real interest rates remain almost historically low.[13] Market-based inflation expectations for the next few years have risen substantially, and the shortest real interest rates, such as day-to-day real interest rates, have fallen sharply since late September. Longer-term inflation expectations have risen moderately during the same period, and the expected risk-free interest rate for a longer horizon has therefore increased only slightly, see chart 17.[14] An increase in inflation expectations is generally expected to stimulate private consumption and corporate investments through lower real interest rates, see literature review in Adolfsen et al (2020).[15] Thus, the rise in inflation expectations since the autumn has partly offset the increase through higher nominal risk-free interest rates on financing conditions.

13 The expected real interest rate is the difference between the nominal interest rate and the expected inflation rate. See Jakob Adolfsen, Mikkel Bess and Jesper Pedersen, Real interest rates are affected by inflation expectations, *Danmarks Nationalbank Analysis,* no. 19, October 2020.

14 Different decisions may depend on real interest rates with different maturities. Big decisions for households, such as the taking-out of a mortgage, and big corporate investments in, say, buildings, machinery or equipment have a long-time horizon. The development in long-term real interest rates must therefore be expected to have the greatest impact on such decisions.

15 See Jakob Adolfsen, Mikkel Bess and Jesper Pedersen, Real interest rates are affected by inflation expectations, *Danmarks Nationalbank Analysis,* no. 19, October 2020.

However, the nature of an increase in inflation can impact different decisions differently. For example, for companies it is of great importance whether inflation leads to higher selling prices for their products or simply higher costs related to production.[16]

Rising mortgage rates and moderate credit growth for households

Households have a savings surplus

For a number of years, Danish households have been characterised by savings surpluses and rising wealth, particularly as a result of increasing house and equity prices.[17] Growth in borrowing has been moderate in recent years, but households' gross debt remains high in Denmark compared to other countries. The high level of debt must be seen, among other things, in light of the growth in pension savings and housing wealth, as well as the low financing costs.[18]

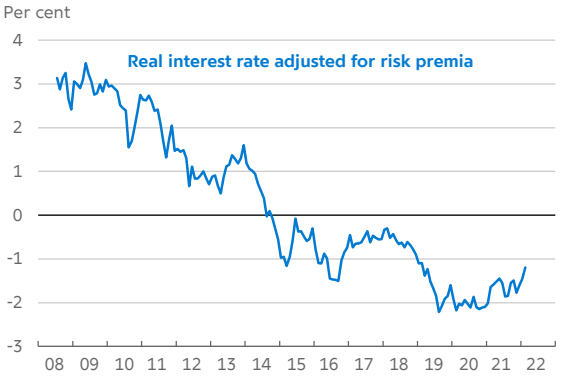
Higher yields across the mortgage rate curve increases financing costs

Danish mortgage bond rates have risen over the past six months for all loan types, see chart 18. The rising rates have been driven, among other things, by higher inflation, as well as expectations of a tightening of monetary policy in the euro area, see the *Global financial market development* section.

Increasing rates on fixed-rate loans boosted by rising risk premia

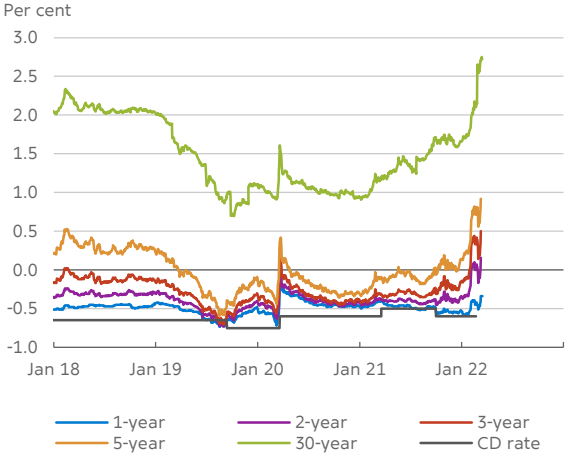
In the course of 2021, long-term mortgage bond yields rose steadily, and the development has continued into 2022. The increase has given rise to the opening of 2.5 per cent and most recently 3 per cent 30-year mortgage bonds. In comparison,

Low real interest rate in euro area despite recent rise Chart 17



Note: Ex-ante real interest rate for the euro area based on 5Y5Y inflation swaps adjusted for inflation risk premium. The nominal rate is a German 5Y5Y zero-coupon government bond rate. See box 1 for further details. The latest data point is February 2022. The financial products used are not available for Denmark. Due to the fixed exchange rate policy, real interest rates in Denmark are expected to broadly follow real interest rates in the euro area.
Source: Danmarks Nationalbank.

Interest rate increases in 2021 have continued into the new year Chart 18



Note: At-par interest rates. The latest data point is 10 March 2022.
Source: Nordea Analytics and Danmarks Nationalbank.

16 See Jakob Adolfsen, Mikkel Bess and Jesper Pedersen, Real interest rates are affected by inflation expectations, *Danmarks Nationalbank Analysis,* no. 19, October 2020.

17 See Danmarks Nationalbank, War in Ukraine dampens growth and increases prices, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, no. 5, March 2022.

18 See Andreas Kuchler, Henrik Yde Andersen and Niels Lynggård Hansen, Mandatory pension savings and long-run debt accumulation: evidence from Danish register data, *Danmark's Nationalbank Working Paper*, no. 156, June 2020.

a year ago coupon rates were approximately 1 per cent. A contributing factor is the rising option-adjusted mortgage rate spread to government bonds (OAS), which has increased significantly compared to early 2021 and further in 2022, see chart 19.[19] The OAS increase is happening in the wake of considerable increases in the duration of callable mortgage bonds.[20] Since 2015, during periods of significantly increasing durations, Danish institutional investors have remained net buyers of Danish mortgage bonds. This has limited the potentially self-reinforcing effects of the increasing duration on interest rate developments.[21,22] At the same time, institutional investors have reduced their demand for other long-term bonds, such as government bonds, which has contributed to the widening of the Danish government bond spread to Germany, see the *Global financial market development* section.

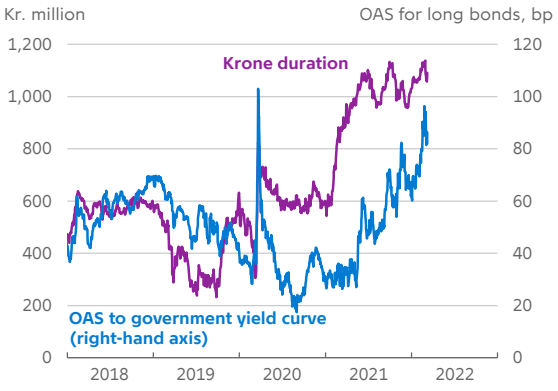
Interest on adjustable rate loans is also up

Since the turn of the year, yields have also risen on bonds behind adjustable rate loans, see chart 18. Until then, yields on the shortest-term bonds behind F1 loans had closely followed developments in Danmarks Nationalbank's monetary policy interest rates. For example, Danmarks Nationalbank's independent interest rate cut on 1 October was transmitted to bond yields, see the *Danish monetary and foreign exchange market* section. For adjustable rate loans, interest rate increases have been particularly pronounced for the longer fixed interest periods.

Household credit growth has been moderate

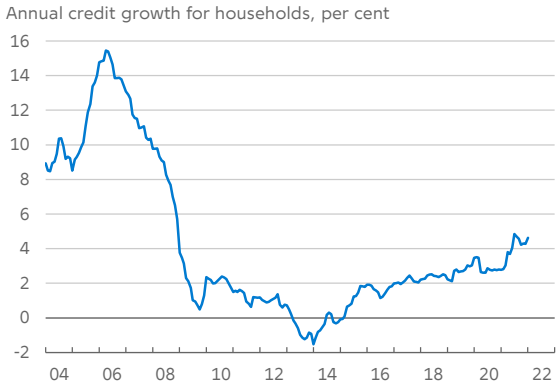
The annual growth rate in total household borrowing remains moderate and has been around 4 per cent over the past six months, see chart 20. The

OAS increases have contributed to higher long-term bond yields Chart 19



Note: Krone duration indicates the market sensitivity associated with a 1 bp rate increase for the total outstanding amount of long-term fixed-rate mortgage bonds. OAS specifies the option-adjusted mortgage rate spread to the government yield curve. The latest data point is 9 March 2022.
Source: Nykredit Markets and Danmarks Nationalbank.

Household credit growth has been moderate Chart 20



Note: Lending in all currencies by monetary and mortgage credit institutions to households, here limited to employees etc. The latest data point is January 2022.
Source: Danmarks Nationalbank.

19 OAS reflects the additional return required by an investor for buying the expected cash flow of a mortgage bond as opposed to holding a portfolio of short-term interest products or government bonds (in this case) and is a risk premium for mortgage bonds.

20 The Danish bond market differs from the bond markets of other comparable countries due to the large segment of callable mortgage bonds. These bonds can always be called at par (100). This option has a bearing on the interest rate risk (duration) of bonds, which increases in case of interest rate increases.

21 See Achord et al., Domestic bond portfolio adjustments during duration jumps, *Danmarks Nationalbank Economic Memo*, no. 10, December 2021.

22 During 2021, the insurance and pension (I&P) sector has been a major buyer of callable bonds, contrasting with the situation in recent years where foreign investors have been the primary buyers of callable mortgage bonds.

increase in total household borrowing has in recent years primarily been driven by new home buyers, see chart 21. Borrowing associated with housing transactions depends on transaction numbers and price developments in the housing market.

Rising house prices have previously spurred additional borrowing

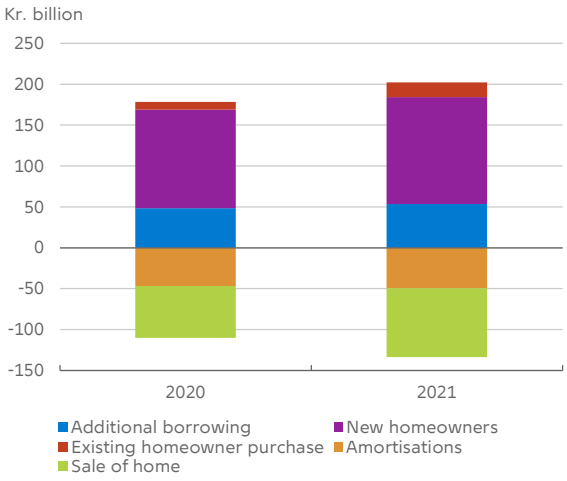
During the covid-19 pandemic, activity in the housing market has been high, and prices have risen significantly, driving an increase in the value of home equity.[23] Thus, the portion of housing wealth eligible for mortgage-based equity extraction increased by kr. 260 billion from the end of 2019 to the end of 2021, see chart 22.[24] This corresponds to an increase of 40 per cent, the bulk of which was accumulated during 2021. Moreover, additional home equity can be extracted through the raising of bank debt.

During previous financial cycles, credit growth has occurred with some delay after periods of rising house prices.[25] In the post-financial crisis period, households have largely consolidated and increased their wealth. Changed behaviour, together with changing economic conditions, may therefore impact the time lag between activity in the housing and loan markets, along with the level of home equity extraction through additional borrowing. Against that background and as a result of the substantial house price increases during the pandemic, it is essential to monitor the development in additional borrowing by existing homeowners.[26]

Additional borrowing by existing homeowners currently remains stable

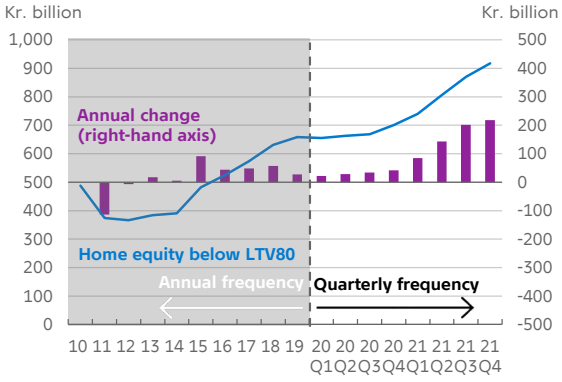
Existing homeowners make up a much larger share than new homeowners. Thus, an increase in additional borrowing by existing homeowners, following a rise in house prices, has a considerable impact

New homeowners have accounted for most of the credit growth in 2021 Chart 21



Note: Annual change in outstanding debt by contribution types. The chart does not include homeowners with no mortgage debt.
Source: Danmarks Nationalbank.

Home equity rose significantly in 2021 Chart 22



Note: The chart does not include homeowners with no mortgage debt.
Source: Danmarks Nationalbank.

23 See Danmarks Nationalbank, War in Ukraine dampens growth and increases prices, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, no. 5, March 2022.

24 Includes only homeowners with existing mortgages.

25 See Grinderslev et al. (2017), Financial cycles: What are they and how do they look in Denmark? *Danmarks Nationalbank Working Paper,* no. 115, June 2017. However, it is important to keep in mind that growth includes borrowing by both businesses and households, including both buyers and existing homeowners.

26 See Danmarks Nationalbank, War in Ukraine dampens growth and increases prices, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, no. 5, March 2022.

on aggregate credit growth for households. So far, mortgage-based equity extraction by this group has been limited, reflecting that the extent of top-up loans and additional borrowing in connection with mortgage refinancing has remained relatively flat in recent years, see chart 23.

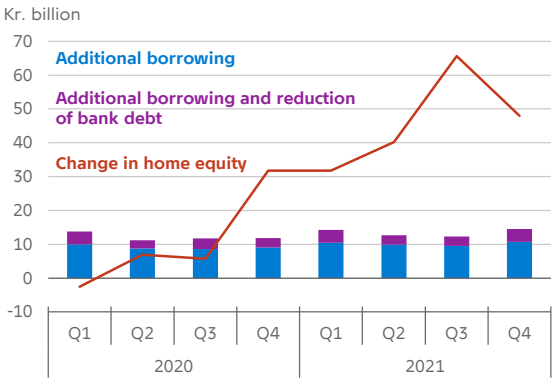
Homeowners can finance consumption, including durable consumer goods and home improvements, through loans secured against their property. Previous studies based on episodes of high levels of mortgage refinancing in 2019 have shown that about 60 per cent of additional borrowing in connection with mortgage refinancing to lower-rate loans is used for consumption or home improvements.[27]

In 2020-21, homeowners arranged additional borrowing of kr. 11-14 billion per quarter. On average, 25 per cent of the additional borrowing has been used to reduce bank debt secured against the same property. In addition, some of the additional borrowing may have been used to increase other household assets, but the extent of this cannot be calculated at this time. Overall, on this basis it is assessed that about 60-75 per cent of equity extraction by existing homeowners potentially goes to consumption, equivalent to kr. 31-38 billion annually during 2020-21, thereby stimulating economic activity.[28]

Homeowners typically extract one fifth of the increase in home equity in the subsequent years

A review of all homeowners who have owned their home for at least five years in the period 2010-20 shows a statistically significant correlation between rising home equity and increasing mortgage debt. Model estimates thus show that, viewed in isolation, mortgage debt increases over the following three years by an amount equivalent to 19 per cent of the increase in home equity, see box 6. The isolated effect of increased home equity on credit growth should be viewed in light of the amortisations continuously made by existing homeowners,

Additional borrowing in connection with mortgage refinancing has yet to increase Chart 23



Note: The chart does not include homeowners with no mortgage debt.
Source: Danmarks Nationalbank.

which naturally drive down credit growth, see box 6. Under the current assumptions about house price and interest rate developments[29], existing homeowners' credit growth is expected to remain around 0.5 per cent in 2022, which is in line with the past two years, and then decrease in 2023-24, see box 6.

Large wealth supports increased household investments in securities

The accumulation of Danish households' wealth was further accelerated during the covid-19 pandemic with the disbursement of frozen holiday funds and limited consumption opportunities. In combination with the widespread adoption of negative deposit rates, this has led to a significant increase in household investments in securities.[30] In 2021 alone, households purchased investment fund shares, individual equities and bonds for an amount of kr. 57 billion, see chart 24. By comparison, their purchases totaled kr. 22 billion annually from 2018-20, with the majority being in 2020.

27 See Danmarks Nationalbank, Mortgage refinancing supports private consumption, *Danmarks Nationalbank Analysis*, no. 17, September 2019.

28 The 75 per cent must be seen as an overestimation as a part of this share may be used to boost savings for unforeseen expenses or for investing in equities or bonds.

29 See Danmarks Nationalbank, War in Ukraine dampens growth and increases prices, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, no. 5, March 2022.

30 Household customers have responded to the prospect of negative deposit rates by increasing the demand for investment fund shares, see Rasmus Kofoed Mandsberg, Alexander Meldgaard Otte and Morten Spange, The response of household customers to negative deposit rates, *Danmarks Nationalbank Analysis*, no. 9, 2021.

Home equity increases are extracted only to a moderate extent

Box 6

Almost one fifth of a home value increase is extracted after three years

To understand the effect of house value increases on credit growth in recent years, a regression model based on mortgage loan data at the household level is used. The model can estimate the growth in a given household's outstanding mortgage loans based, among other things, on the change in home equity in the three previous years, characteristics of the household's existing loans and indicators for liquidity buffers. The model is estimated using a fixed effects panel regression on data from the period 2010-20, and a model-consistent projection is made for 2021-24 based on the model parameters and the main scenario for the economic development.[1] This means that the projection is based on the historical behaviour of homeowners during the estimation period. The primary purpose of the model is to assess the level of existing homeowners' additional borrowing. It is therefore estimated only for households which have been homeowners in each of the four previous years. The results show that 11 per cent of a home equity increase is extracted in the next year, and that 5 and 3 per cent, respectively, are extracted in the following two years. Overall, 19 per cent of a given home equity increase is thus extracted after three years, see chart (left). This is roughly equivalent to the level found in previous studies.[2]

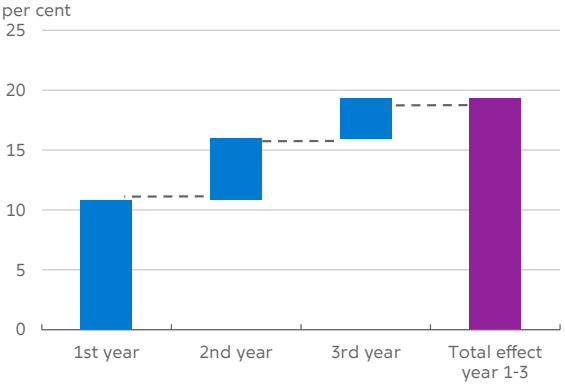
The contribution of existing homeowners to credit growth also depends, among other factors, on their amortisations

In addition to the estimated propensity to extract home equity, a number of other factors also determine the development in household mortgage debt over time, including in particular ordinary amortisations. Overall credit growth is relatively low among existing homeowners, even during periods with house price increases (blue curve in chart, right). The estimated growth in mortgage lending for existing homeowners in 2022 is 0.5 per cent and thus in line with the growth in 2019 and 2020. In 2023-24, the model points to credit growth from existing homeowners falling to -0.6 and -2 per cent, respectively. One reason is that the effect of the large increase in home equity in 2021 is declining, and another is that mortgage rates are assumed to rise slightly.

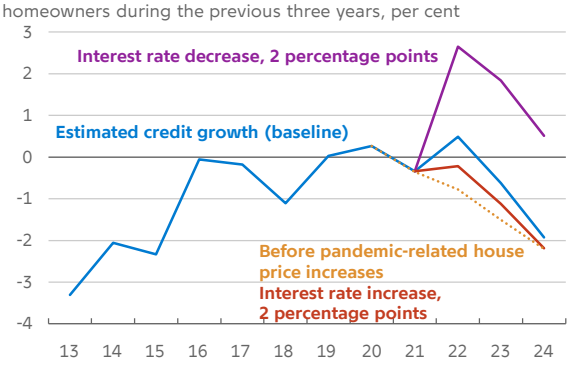
...to be continued

Home equity increases are extracted only to a moderate extent

Share of home equity increase extracted in subsequent years, per cent



Estimated growth in mortgages among households which have been homeowners during the previous three years, per cent



Note: The left-hand chart is based on coefficient estimates for lagged changes in home equity in a fixed effects panel regression with the change in household mortgages as the dependent variable. A number of control variables are included in the model. The right-hand chart is estimated credit growth based on the same model. The model is estimated for 2010-20, and a projection is made based on the model and house price developments, see Danmarks Nationalbank's latest projection. The baseline scenario assumes market expectations for the interest rate level during the projection period. Two different scenarios for interest rate developments have been analysed, with interest rates falling and rising by 2 percentage points, respectively. The interest rate level is included directly in the model as well as indirectly in the part of the model that assesses for a given household whether it is attractive to refinance one or more existing fixed-rate loans to loans with a lower coupon rate. In the scenario with an interest rate increase, it is assumed that interest rate increases have the same effect on the refinancing of fixed-rate loans as interest rate decreases (i.e. households refinance their loans to higher-rate loans in the case of interest rate increases to the same extent as they refinance their loans to lower-rate loans in the case of interest rate decreases). The scenario with an interest rate increase is therefore an overestimate of the expected additional borrowing in the case of an interest rate increase. The last scenario in the chart shows the expected development in the event that pandemic-related house price increases had not occurred. Here a house price increase of 3 per cent in 2021 and 2.4 per cent in each of the years 2022-24 is assumed.

Source: Own calculations based on data from Statistics Denmark and Danmarks Nationalbank.

1. See Danmarks Nationalbank, War in Ukraine dampens growth and increases prices, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, no. 5, March 2022.
2. See Simon Juul Hviid and Andreas Kuchler, Consumption and savings in a low interest rate-environment, *Danmarks Nationalbank Working Paper*, no. 116, June 2017.

Home equity increases are extracted only to a moderate extent

Box 6

...continued

Interest rate fluctuations lead to refinancing of fixed-rate loans and make additional borrowing more likely

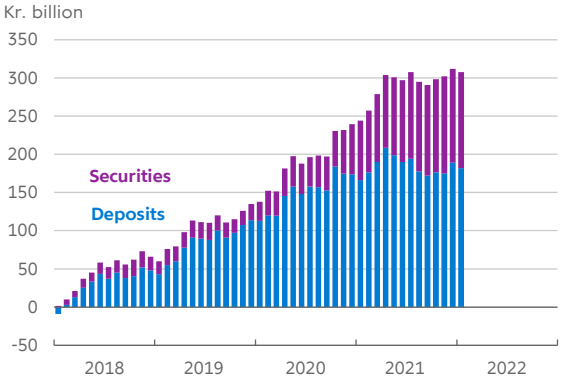
Results from the model estimates also show that households are particularly likely to increase their lending when it is attractive to refinance their existing fixed-rate loans to loans with a lower coupon rate. This thus suggests that additional borrowing often takes place in connection with mortgage refinancing. Interest rate developments will consequently have an impact on the portion of households increasing home equity which are extracted.

If interest rate developments again make refinancing desirable, credit growth among existing homeowners may increase significantly, as seen in the scenario where the interest rate on callable loans decreases by 2 percentage points relative to the baseline scenario (purple curve in chart, right). Credit growth will be slightly lower if assuming alternative interest rate developments, with 30-year mortgage rates being 2 percentage points higher than the baseline scenario (red curve in chart, right). This is based on the assumption that households find it just as attractive to refinance their fixed-rate loans when interest rates have risen as when interest rates have fallen. The scenario with rising interest rates should also be seen in the light of rising borrowing costs, which, viewed in isolation, reduce the loan demand, while the opposite is true of the scenario with interest rate decreases. The last scenario (orange curve in chart, right) is a counterfactual scenario illustrating the model's estimate of credit growth in the event that house prices had developed as expected in September 2019. The difference between the estimated growth in debt in this scenario and the baseline can be considered as the isolated effect of the rising house prices during the pandemic, averaging 0.8 percentage points in 2022-24.

In addition, positive returns have increased the market value of household financial assets despite the downturn in early 2022. Overall, household holdings of securities have increased from kr. 920 billion at the beginning of 2021 to kr. 1,062 billion in January 2022. Households' increased holdings of securities contribute to the fact that, for example, the development in equity prices may have a greater effect on private consumption.[31]

In 2021, stagnant bank deposits were replaced by larger investments

Chart 24



Note: Accumulated net transactions of Danish households.
Source: Danmarks Nationalbank.

31 Empirical studies indicate that households have a marginal propensity to consume at wealth gains of around 4 per cent over a period of one year. See Asger Lau Andersen, Niels Johannesen and Adam Sheridan, Dynamic spending responses to wealth shocks: evidence from quasi-lotteries on the stock market, *CEBI Working Paper Series*, no. 11/21, July 2021.

Business corporations have increased their external financing

Corporate earnings have been supported by the economic upswing

Overall, Danish business corporations have coped relatively well during the pandemic, and their activities and employment currently exceed the level prior to the covid-19 outbreak.[32] Profits in listed companies reached a very high level in 2021. Against this background, the dividends and share buy-backs of the largest companies have increased significantly.

The large profits of listed Danish companies were particularly driven by companies within road transport and shipping. Transport prices have increased significantly, which shipping companies such as A.P. Moller - Maersk and logistics companies such as DSV have benefited from.[33] Rising transport and material prices, on the other hand, have reduced earnings in some manufacturing companies. Overall, the increase in earnings is broad based.

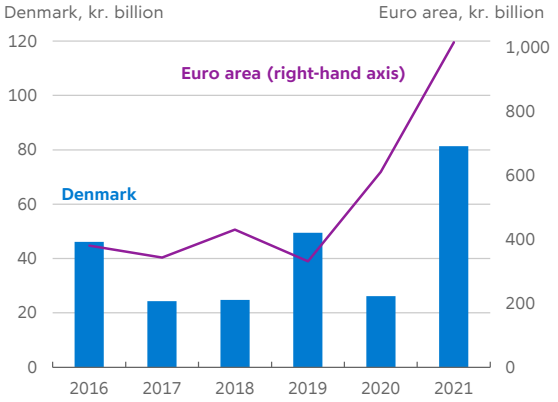
Corporate financing through equity issuance was significant in 2021

Companies in both Denmark and in large Western economies issued equities in 2021 at a much larger amount than in the previous years, see chart 25. The soaring equity prices up to the turn of the year made it attractive to issue new equities and to use the proceeds to acquire other businesses or the like. The fall in equity prices since late 2021 and the heightened volatility following Russia's invasion of Ukraine has resulted in fewer equity issuances in 2022.

Especially companies in innovation-intensive industries raised capital in the equity market in 2021

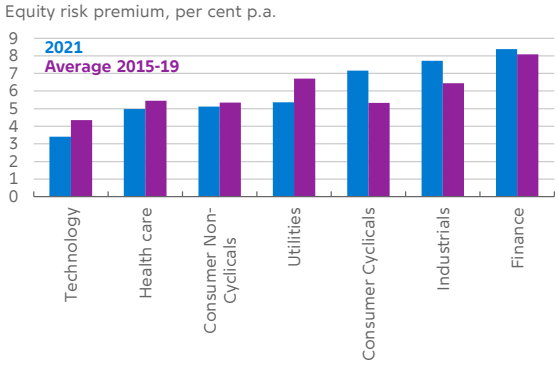
The low interest rate environment combined with a generally high risk appetite among investors particularly supported technology companies' access to financing in 2021. The equity risk premia for companies in the technology sector is thus the lowest

Significant increase in corporate equity issuances in 2021 Chart 25



Source: ECB and own calculations based on securities statistics.

The equity risk premium is lower in the most innovative sectors Chart 26



Note: Average over 2021 for European equities based on Stoxx 600.
Source: Danmarks Nationalbank.

32 See Danmarks Nationalbank, War in Ukraine dampens growth and increases prices, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, no. 5, March 2022.

33 See Danmarks Nationalbank, War in Ukraine dampens growth and increases prices, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, no. 5, March 2022.

among all industries and in 2021 it was below the average for the period 2015-19 based on data for the European market, see chart 26.

In 2021, technology companies accounted for just over 30 per cent of all new issuances in Denmark and 13 per cent in the euro area. In both areas, this represents an increase compared to the years leading up to the covid-19 outbreak. Technology companies typically do not rely on debt financing from banks because they are small and due to high business and operational risks. Conditions in the equity market may therefore reduce the financing costs and may thereby be particularly supportive of the investment activity in parts of the economy. According to data from Vækstfonden, venture capital investments in Denmark have also shown the same increasing trend as financing with equity issuances, reaching kr. 14 billion in 2021 compared to almost kr. 11 billion in total in the previous three years.

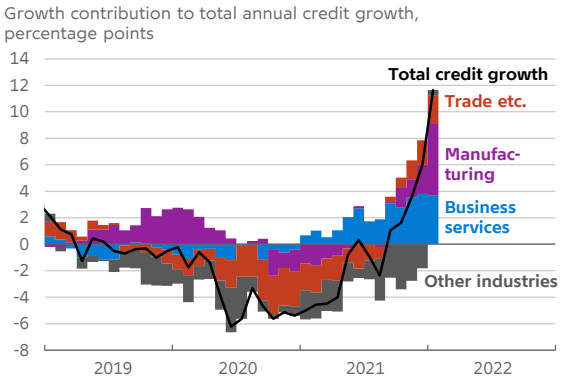
Corporate borrowing from banks has increased over the past six months

The annual growth in lending by banks to Danish business corporations increased to 12 per cent in January 2021, see chart 27. This is a significant increase in comparison to the average credit growth of 0.1 per cent in the period 2015-19, corresponding to annual net borrowing of kr. 49 billion. The increase reflects, in particular, increased borrowing for companies within the trade, manufacturing and business services industries. A few large companies have significantly increased their bank debt in 2021, including with a view to carrying out investment projects.[34]

Higher credit growth also reflects a temporary decline during the lockdown

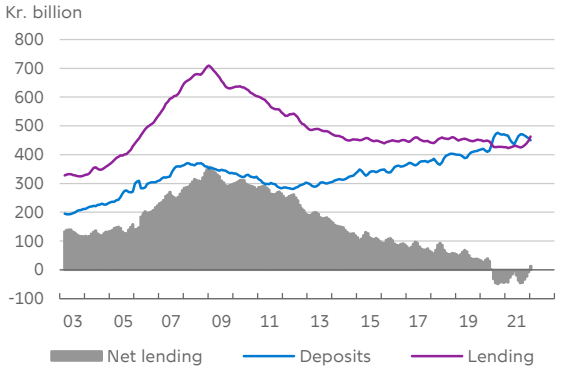
The higher growth in corporate bank debt follows after a significant decline following the outbreak of the covid-19 pandemic and the lockdown of the economy in March 2020. Some of the high credit growth therefore reflects a catch-up to the pre-pandemic debt level, see chart 28. Overall, bank debt is thus only approx. 3 per cent above the January 2020 level.

Corporate borrowing from banks has increased Chart 27



Note: Lending excluding repo from banks to Danish business corporations, which in this context are delimited to non-financial corporations and sole proprietorships. The latest data point is January 2022.
Source: Danmarks Nationalbank.

Corporate bank financing is at the pre-covid-19 level Chart 28



Note: Lending and deposits from banks to Danish business corporations, which in this context are delimited to non-financial corporations and sole proprietorships. The latest data point is January 2022.
Source: Danmarks Nationalbank.

34 In 2021, a sharp increase was seen in gross investments, which supports the growth in the Danish economy. See Danmarks Nationalbank, War in Ukraine dampens growth and increases prices, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, no. 5, March 2022.

At the same time, companies continued to increase their bank deposits.[35]

The expiry of tax and VAT loans may increase corporate debt financing

During the covid-19 pandemic, the deferral of tax and VAT payments supported corporate liquidity and has therefore, to some extent, served as an alternative to traditional debt financing. In Danmarks Nationalbank's lending survey, several of the banks report that they expect increased loan demand in the 1st quarter of 2022, partly as a result of the expiry of covid-19-related central government credits as of 1 April.[36,37] Moreover, part of the repayment of the central government credits may be financed through increased corporate deposits. However, previous analyses have shown that the tax and VAT loans were mainly awarded to companies that were less healthy even before the outbreak of the pandemic.[38]

35 By comparison, the growth in business corporations' mortgage borrowing has developed steadily, with an average growth rate of 3.3 per cent over the past six months.

36 In September 2021, the Danish government and the Danish Parliament (*Folketinget*) decided to extend the maximum period for instalment plans for repayment of coronavirus-related state credits from 12 to 24 months at an interest rate of just under 9 per cent per year. In the event that companies' credit needs continue, the requirement for interest payment is likely to increase the incentive to seek financing from banks at more favourable financing conditions.

37 Overall, companies have taken out covid-19-related loans (VAT and A-tax loans) at a total of kr. 36.1 billion. During 2022, some 50,000 companies will be required to repay coronavirus-related loans at approx. kr. 500,000 on average.

38 See Alexander Meldgaard Otte, Andreas Kuchler and Ida Rommedahl Julin, Firm financing and public support measures during the pandemic, *Danmarks Nationalbank Working Paper*, no. 184, November 2021.

APPENDIX

Monetary and financial trends

March 2022

Appendix

Small banks have increased their net position in line with increasing customer funding surplus

The net position of small banks has been increasing steadily for several years. This is due to an increasing deposit surplus from normal banking operations combined with a relatively simple liquidity management. Small banks are typically less active in the money market and instead place their excess liquidity with Danmarks Nationalbank or in short bonds. The rising customer funding surplus is illustrated for a representative group of small banks in chart A (left). On average, the small banks increased their net position with Danmarks Nationalbank by about kr. 0.6 million when their customer funding surplus increased by kr. 1 million in a given month, see chart A (right). A similar pattern is seen for other small banks for which data is only available on a quarterly basis.

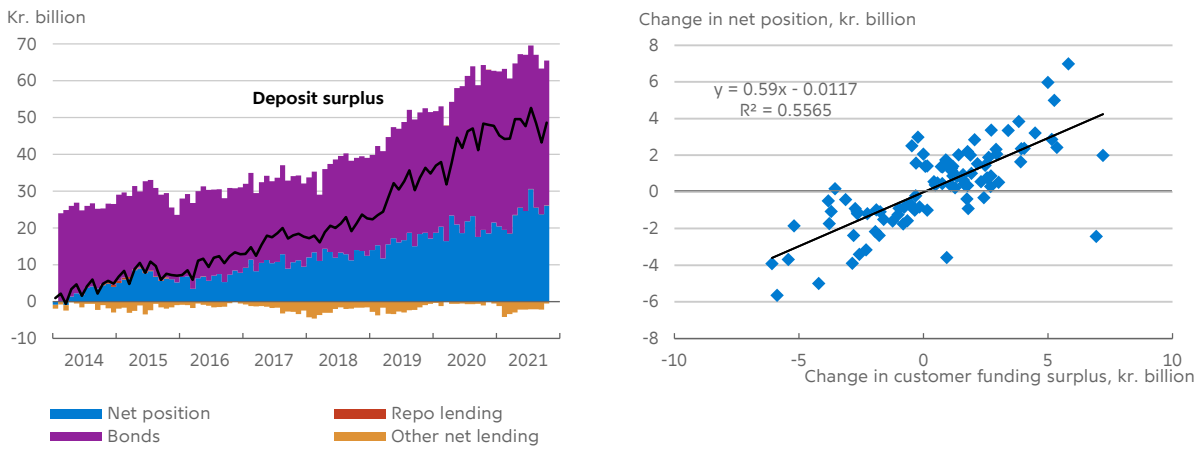
When the large banks hold a lower portion of the net position, liquidity in the money market decreases

The banks' overall net position has decreased slightly compared to before the covid-19 outbreak in March 2020. The mirror image of the increase in the net position of small banks is therefore a declining net position for the large banks. The large banks are intervention counterparts for Danmarks Nationalbank. Interventions in the Danish krone market will therefore either inject liquidity or drain liquidity from the net position of large banks. Broadly speaking, this is also true for the central government's domestic debt issuances. The increase in the central government's account in 2021 was primarily financed through domestic borrowing, and the buyers of government bonds are typically customers with the largest banks. The central government's net expenditures, which have been lower than expected, and borrowing in 2021 have thus contributed to maintaining the net position of the large banks at a relatively low level.

The small banks have only little or no money market activity, see chart B (left). Their liquidity in Danmarks Nationalbank is therefore not available for lending in the money market. A smaller portion of the net position of the large banks which are active in the money market will thus result in lower liquidity in the money market.

A representative group of small banks has increased its net position due to rising customer funding surpluses

Chart A



Note: The group of small banks comprises six banks which report data to the MFI statistics on a monthly basis, but which do not report to DESTR. This then primarily concerns regional banks and savings banks. The development is representative of all the non-large banks. The left-hand chart includes their total customer funding surplus vis-à-vis households and non-financial corporations, their overall net position, bond holding, repo lending and other net lending. The right-hand chart shows monthly changes in the customer funding surplus and the net position for each of the six small banks, respectively. Data is with a monthly frequency from January 2014 to November 2021.

Source: Danmarks Nationalbank and own calculations.

Lower availability of liquidity in the money market increases money market rates

The current reference rate, the Tomorrow-next (T/N) rate, indicates the interest rate at which banks are prepared to lend to one another from tomorrow to the next day without collateral. In theory, each bank's T/N rate depends on the probability of it having to borrow in the money market to cover its liquidity needs. This probability depends, among other things, on:

1. The bank's own net position
2. The overall net position
3. The distribution of the net position between large and small banks (distribution effect).

1) If the bank itself has a low net position relative to its liquidity needs over the next two banking days, the bank will typically fix the T/N rate close to Danmarks Nationalbank's lending rate at which the banks can alternatively lend against collateral on the last business day of the week. Conversely, if the bank has a high net position relative to its liquidity needs, Danmarks Nationalbank's deposit rate will be the guideline for its T/N rate.

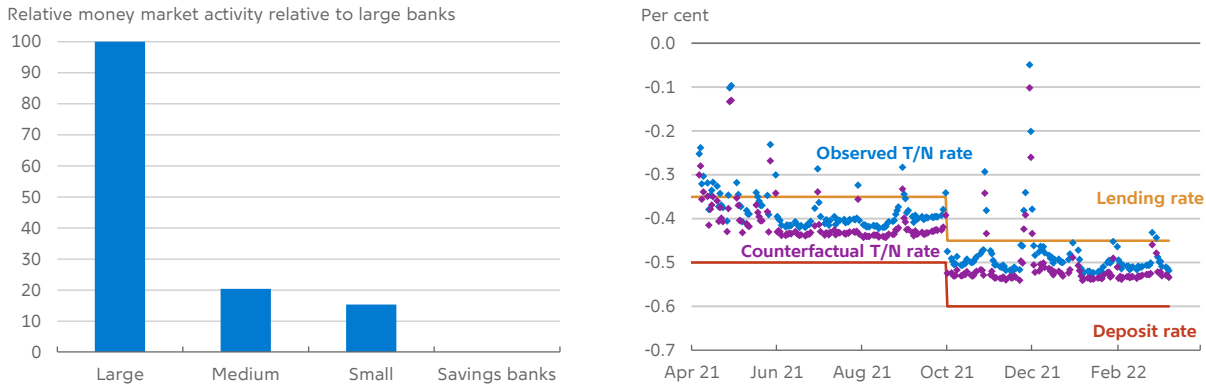
2) If the overall net position is high, the overall supply of liquidity in the money market will also be high, all other things being equal. Other banks will be more willing to provide lending in the money market. A high net position will therefore mean that the T/N interest rates are primarily determined by the deposit rate. If the overall net position is low, the lending rate becomes more of a benchmark rate.

3) As described, the overall supply of liquidity in the money market also depends on the distribution of liquidity between monetary policy counterparties due to differences in business models. A larger portion of the net position held by small banks reduces, all other things being equal, the available krone liquidity in the money market.

Danmarks Nationalbank has established a theoretical model which can estimate the T/N rate given the three effects above, the difference between the deposit rate and the lending rate as well as other factors. According to the model calculation, the changed distribution of the net position has increased the T/N rate by about 3 basis points relative to the starting point before March 2020, see chart B (right). This has contributed to increasing the CITA swap rate and the forward rates.

Chart B: Money market activity is at its highest in the large banks, and the changed distribution of the net position has increased the T/N rate by about 3 basis points

Chart B



Note: Left-hand chart: Estimate of the uncollateralised overnight money market from April to November 2021. Derived using a Furfine algorithm on Kronos payment data. The values for the different banks are scaled in relation to their deposits so the activity can be compared with the activity for the large banks. 'Large' banks are Danmarks Nationalbank's intervention counterparties, 'Medium' are other banks reporting to DESTR, 'Small' are the banks in chart A above, and 'Savings banks' are all other banks engaging in traditional banking operations. Right-hand chart: The effect of the changed distribution of the T/N rate is estimated via a counterfactual trajectory based on Danmarks Nationalbank's model for pricing of the T/N rate. A trajectory is assumed in which the small banks' portion of the net position has remained at the approximately 20 per cent it was at before the distribution changed in March 2020. The observed and counterfactual T/N rates are based on daily observations and reflect a weighted average of all bank-specific fixings of the T/N rate.

Source: Danmarks Nationalbank and own calculations.

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